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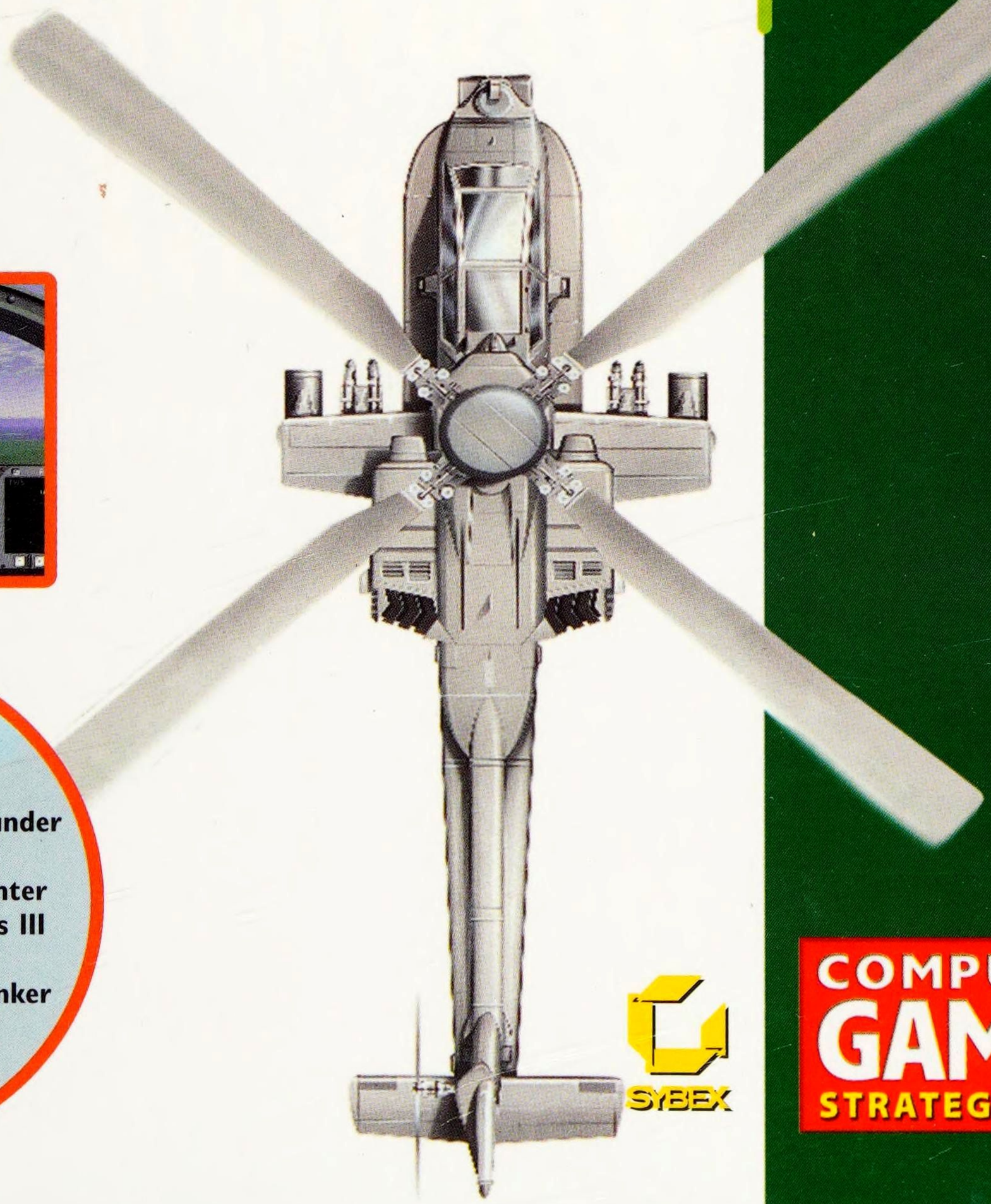

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The Best Simulation Games

Strategies & Secrets™

BY COMPUTER GAMES STRATEGY PLUS

SYBEX

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TABLE OF CONTENTS

CHAPTER 1
The Air Combat Advisor 1

INTERMEDIATE FLYING SKILLS....2
Out on the Edge....2
Know Thy Aircraft....3
Turning....6
INTERMEDIATE MARKSMANSHIP....12
Guns! Guns! Guns!....13
ADVANCED FLYING SKILLS....16
Airspeed versus Control....16
Excessive Top Rudder Stall....17
Spin Again....18
AIR COMBAT BASICS: CLOSING....19
Heads or Tails....19
Offense or Defense....20
Situation Relation....20
Mission Specific Goals....20
Position Magician....21
PASSS....21
Final Closing Tips....22
AIR COMBAT BASICS: ATTACK!....22
Kinds of Attack....23
Energy Conversion....25
AIR COMBAT BASICS: MANEUVERING....26
E is for Energy....26
Gravity: It's the Law....28
Newton's Laws—Friend or Foe....28
Strategy Aspects....29
AIR COMBAT BASICS: DISENGAGE....33
What It Is....34
Run Away!....34
The Realities of Disengage....36

CHAPTER 2
AH-64D Longbow 39

GETTING THROUGH MISSIONS....40
The Briefing....40
Planning....41
FLYING TIPS....42
The Art of Not Being Seen....43
Finding and Selecting Victims....43
TAKING SIGHT OF THE ENEMY....45
Targeting by Man or Machine? TADS versus FCR....45
More Fun with Acronyms: TSD and ASE....47
How I Learned to Love the U Key....48
Look, Ma, No Hands!....49

CHAPTER 3
Apache: The Combat Helicopter Simulation 51

FLIGHT BASICS 52
Hog and Bog 53
Effective Collective 53
HUDs Up! 53
Hardware Heaven 54
How High Am I 54
FLYING APACHE 55
Surf's Up, Dude 55
Hovering 56
INSTRUMENT SCAN 56
Two Seats and Only Two Eyes 58
Threats 59
Landing 60
INTERMEDIATE SKILLS 61
Air Threats 61
Defensive Strategies 62
On the Offensive 63
Mountain High 64
CAMPAIGN & ADVANCED SKILLS 64
Campaign Blues 65
MISSION UNDER FIRE 68
Mission Briefing 68
Scramble into the Storm 69
Into the Thick of Things 70
FOR OVER THE NET 72
Modem Madness 73
H2H 74

CHAPTER 4
Advanced Tactical Fighters 79

LISTEN UP, ROOKIE! 80
Proper Prior Planning Prevents Poor Performance 81
Waypoints: What's It All Mean? 81
THE DAMAGING FACTS! 85
Keeping Score Bullet by Bullet 85
Missile Lethality and Airframe Construction 86
It's Far Better to Give Than to Receive! 87
Ships and Structures: About Air-To-Mud 88

CHAPTER 5
Flight Unlimited 91

PRACTICE MAKES PERFECT 92
Hit the Books 93
The Need for Speed 94
Throttle Jockey 94
Smooth Moves 96
Da Rudder 97
Which Way Is Up? 98

How Much Rudder? 99
Other Rudder Uses 100
Torque and Propwash 100

CHAPTER 6
Flight Simulator 5.1 103

ALMOST LIKE THE REAL THING 104
Really Basic Training 105
The Famous "10, 10, & 100" 105
WEATHER VARIABLES 110
Into the Goo! 115

CHAPTER 7
Eurofighter 2000 117

USING AIR-TO-AIR WEAPONS 118
Death from a Distance 119
Long-Range Missiles 119
Short-Range Missiles 120
The Gun Is Your Last Resort 122
EARTHMOVING EQUIPMENT 123
Iron Bombs: An Inexpensive Real Blast! 123
What Is That Ruby Red Light? 124
Shotgun! 124
Smile, You're on TV! 124
Durandal, Destroyer of Runways! 125
CLUs: The Rain of Death 125
Sound the Alarm! 126
Abandon Ship! Abandon Ship! 126
Defense! Defense! 126

CHAPTER 8
World Circuit Racing: Grand Prix II 129

GETTING AROUND THE COURSE 130
Texture Lecture 132
Performance without Control Is Nothing 132
Learn from the Pros 133
Driver's Ed 134
GETTING THE FEELING 134
We're All Different 135
Testing, Testing, Testing 136
Mechanical Grip versus Aero Grip 136
Gear Head 137
Wingin' It 138

CHAPTER 9
Back To Bagdad 141

KICKIN' UP THE DESERT SANDS 142
Gettin' Ready to Rock 'n' Roll 143

Training before Getting Those Kills 145
Close It Up 145

CHAPTER 10
IndyCar Racing II 149

A TOUGH ROAD TO FOLLOW 150
Preparations 151
Getting Good 152
The Track 153
GARAGE ADJUSTMENTS AND VIOLENT CRASHES 155
Burning Rubber 156
Wings and Suspension 158
Hot Crash Spots 158
The Last Word 161

CHAPTER 11
Silent Hunter 163

TACTICS FOR THE HUNTER AND THE HUNTED 164
The Approach 164
The Attack 166
The Escape 167
Back at the Academy 168

CHAPTER 12
U.S. Marine Fighters 171

A BOOT CAMP, OF SORTS 172
Frame Game 172
Copy Your Pilot 173
Chance Ordnance 174
Radar Warning Receiver 174
If You're Not Cheating You're Not Trying 175
Vertical Take Off and Landing 177
Miscellany 177

CHAPTER 13
Tower 181

TOWER TO PILOT 182
Proper Prior Preparation 182
On with the Show! 183
Setting Up the Office 184
Making the Most of Your Facilities 186

CHAPTER 14
Flight Simulator Flight Shop 189

AN AIRPLANE HOBBY SHOP ON A DISK 190
I Can't Read This Manual! 190
Everybody into the Pool 191

Bulking Up 193
Assembly Line Production 193
THE CREATION CONTINUES 194
Not Quite like the Prototype! 194
Get the Point? 194
Add the Landing Gear 195
Off to the Paint Shop 198
Take Her to the Air! 198

CHAPTER 15
Fighter Duel 201

HEAD-TO-HEAD TACTICS 202
Your Aircraft of Choice 203
The Head-on Pass 204
Watch for Slow Speeds! 206

CHAPTER 16
Warbirds 209

BASIC STRATEGY 210
The Mustang 211
Combat Tactics 212
Know Your Plane's Limitations 213

CHAPTER 17
NASCAR Racing 215

DOWN 'N' DIRTY 216
Choose Your Weapons 216
Turning the Wrenches 220
Tires: Your Link to the Track 222
Suspension 226
Weight Management 229
Gearing 231
Gearing for the Ovals 231
Aerodynamics 233
Qualifying 235

INTRODUCTION

The Best Simulation Games Stategies & Secrets is a treasure chest for computer gamers. This combination book/CD/magazine subscription, specifically devoted to PC simulation gamers, is one of the best buys on the market today.

THE SUBSCRIPTION

This book/CD package includes a six issue subscription to *COMPUTER GAMES Strategy Plus* magazine. Send no money—your subscription is already paid. To activate your subscription, simply tear out the form at the back of the book, fill it out, fold, seal, put a stamp on it, and mail it. (If you're already a subscriber, your subscription will be extended for six issues.)

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THE BOOK

This book is packed with hints, tips, and strategies for playing computer simulation games—all written by some of the world's leading reviewers and players of simulation game products. These veterans of the cockpit have logged many hours of simulated flight and driving to discover the secrets of the games so you may log your own hours of simulated fun and adventure. In this collection, they share with you the important tips; successful, and some unsuccessful, strategies and tactics; and, in desperate situations, the cheats necessary to get you from point A to point B in one piece, no matter which simulation you choose to enjoy.

The chapters in this book cover today's most popular, best-selling, and challenging simulation games for the PC. Whether you want to undertake support or intelligence missions with a helicopter in Jane's *AH-64D Longbow* or Interactive Magic's *Apache*; log your air miles in an F-16 in *Back To Baghdad* from Military Simulation, Inc.'s or Microsoft's *Flight Simulator 5.1*; or take to the motor speedway in Papyrus's *IndyCar Racing II*, you can get all of the valuable sim information you need in this book.

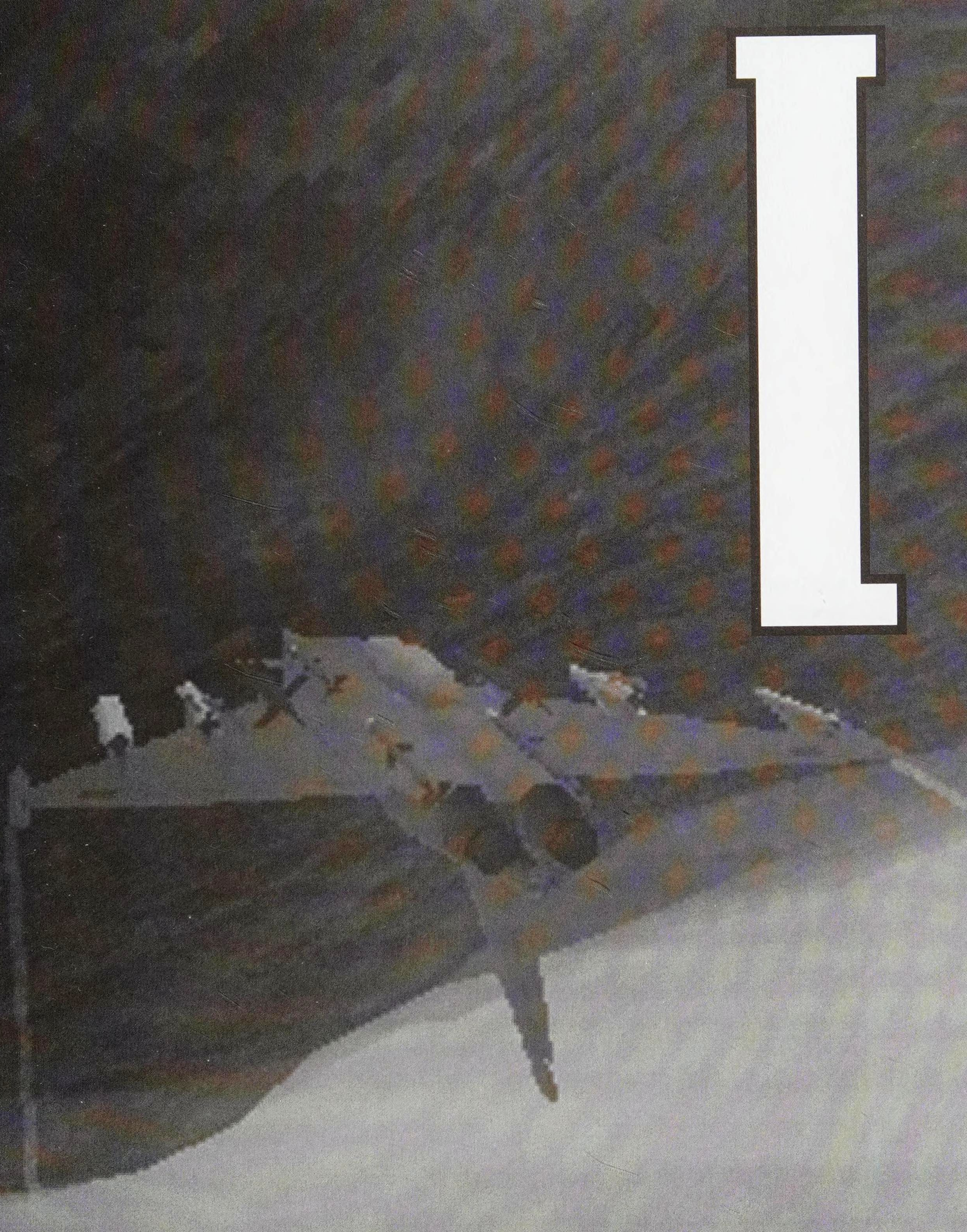
Before you dive into specific games, though, take a look at the first chapter, "Air Combat Advisor," which is a compilation of detailed technical points for flying aircraft

that applies whether you're playing flight simulation games or really taking flying lessons! This chapter, along with several others in this book, was written by Ben Chiu, a top-notch ace when it comes to the finer details of successfully enjoying simulations.

The balance of *The Best Simulation Games Strategies & Secrets* presents a liberal arrangement of simulations for the PC, from flight simulations in peaceful or wartime skies to the hot and gritty cockpit of a Formula 1 race car. After studying the technical intricacies of simulation flight in Chapter 1, and the specific hints and tips in the chapters covering your favorite games, you will have all the information you need to carry out your flight plans, missions, or races in your on-screen simulated environments.

THE CD-ROM

The CD-ROM at the back of this book includes demos of some of the games presented in this book as well as some other goodies. You'll find hours of entertainment with these playable demos. There's nothing like seeing if you'll really like a game, before you plunk down $50 or $60 for it. After you've mastered one of your favorite war games, check out the CD and install a demo for another game that you always wanted to try out.



The Air Combat Advisor

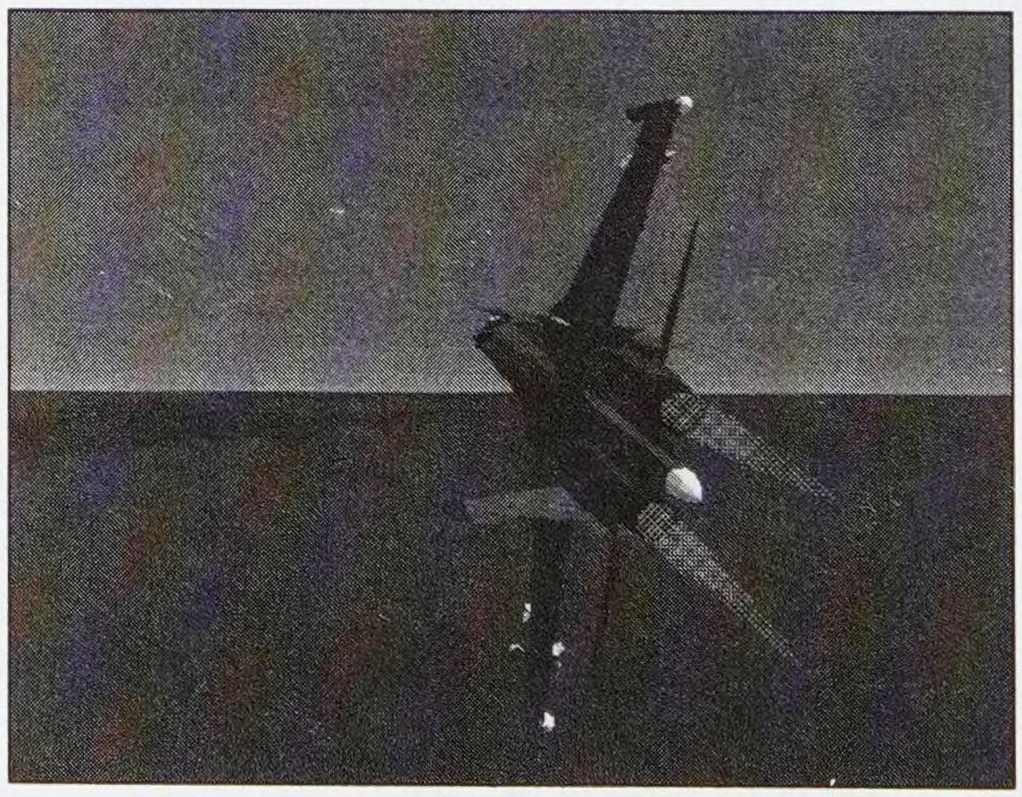
Before you grab that joystick and get ready to fly your way through the many flight simulations covered in this book, you may want to prepare your efforts with a study of this chapter. The Air Combat Advisor offers a comprehensive discussion of flying skills and combat maneuvers, both from offensive and defensive perspectives. So strap yourself in, and use these general strategy tips to train yourself for your favorite flight simulations.

INTERMEDIATE FLYING SKILLS

Let's begin with a discussion on a couple of intermediate topics. We'll use *1942: Pacific Air War* (PAW) from MicroProse as an example simulation game.

OUT ON THE EDGE

If you were to plot the flight performance of an airplane on a graph, you'd end up with a diagram that would look like a slanted square or rectangle. This box is commonly referred to as the flight envelope. Naturally, plotting all the flight capabilities of an airplane would require several graphs, but generally the



flight performance envelope refers to a diagram of aircraft flight performance. In its simplest terms, the lines that make up the outer edges of the envelope mark the exact points where the aircraft transitions from flying to not flying. While some fighters may share similar flight envelopes, the majority of them do not because different airplanes have different performance capabilities.

The significance of the flight envelope is that if you can fly your airplane at its performance limits; you'll be able to turn tighter, fly higher, and fly faster than your *hopefully* less-skilled opponent. This obviously is an advantage if your opponent is flying an equal or inferior airplane than you. However, there is a common misconception that this skill is of less value for those flying a lower-performance aircraft. If you're put in a situation where you're flying a lower-performing airplane than your opponent, being able to fly your airplane at the outer edge is sometimes the only way to level out the *uneven* playing field.

KNOW THY AIRCRAFT

Building your piloting skills to fly out on the edge can be broken down into three steps: learn the limits, learn to recover if you go beyond the limits, and learn to stay reasonably within the limits. One way to learn about your aircraft is to read and memorize airspeed specifications. This requires studying, which isn't real popular with many armchair warriors who fly for enjoyment. The most fun and arguably best way to learn about your airplane is to fly it and explore its limits. As a sim pilot you can afford to do this because the worst thing about crashing your plane in a training mission is having to wait for your mission to reload.

In order to learn the limits of an airplane, you have to know what the limit and beyond looks and feels like. Flight sims with good flight models such as the ones featured in *Pacific Air War* make this easy for you. *Pacific Air War* models aircraft buffeting, spins, and structural failures. The buffeting signifies maximum limit warnings. Spins and structural failures tell that you went past the limit. Explore and make notes on how fast and how slow your airplane can fly and still remain in control and in one piece. See how steep of an angle you can turn while level, climbing, and descending without spinning. Try everything that you can think of, such as finding minimum airspeed required to do a loop from level flight.

All in the Stall

Now let's turn to what happens when you cross the limit. The majority of flight performance problems are caused by stalled flying surfaces. Contrary to what many armchair pilots will tell you, stalls are not caused by low airspeed. Stalls are caused by exceeding the critical angle of attack (the angle between the wing chord line and direction of relative wind). The scenario that makes very low airspeed seem like the culprit arises because low airspeeds generate less lift. When the pilot tries to compensate for the loss of lift and altitude by using more elevator, this causes the wing to exceed the critical angle of attack. An airplane will compensate for flying too slow by lowering its nose all by itself if left alone. Naturally this critical angle of attack is different in different wing designs, but nevertheless, an airplane can be stalled at any airspeed and at any flight attitude, altitude, or power setting. While this may be scary if you think about it, the good news is that stalls are pilot-induced. This means *you* have control over them.

Spin Again

Spins are also caused by stalls. What causes an airplane to spin is one wing is producing lift when the other is stalled. To enter a spin, the airplane must first and always be stalled. This means if you never stall your airplane, you'll never spin.

Recall the Stall

To avoid the spin, go easy on the elevator. This helps keep you flying by keeping you away from that critical angle of attack, but it makes for sloppy and wide turns. Because turning tighter increases your maneuverability (and hopefully your kill ratio), let's look at how to recover from stalls. Stalls are categorized as either elementary or advanced. Elementary stalls include power on, power off, and turning stalls. Advanced stalls include cross-control, accelerated, top, and bottom rudder stalls. When you *feel* the airplane buffet, release back pressure on the stick. If you are in a high bank, neutralize your ailerons and return to level flight. If you are at a low power setting, increase power. Since *Pacific Air War* models engine torque, use right rudder to correct for it.

The Need of Excess Speed

The remainder of pilot-induced flight problems result from flying too fast. There are two situations where you're likely to exceed maximum speed in a high-performance prop airplane: while diving and at max cruise descent. The difference is in the angle of descent. Generally, anything beyond a 1,000 FPM descent (approx. 20–30 degrees) is usually considered a dive. Recovery for max cruise descent depends on what your target is.

Basically, when you recognize the buffeting, reduce your throttle setting. Alternatively, you can usually keep the same throttle setting and gently raise the nose of the airplane instead, if you wish. This is a judgment call, but generally if your target is still a long way below you, you're better off reducing throttle. Recovery from a dive requires both throttle and attitude adjustments, although speed brakes, dive flaps, and flaps can assist if you can use them. Again, your choice depends on your target and what the sim will let you do.

Recover and Regroup

Now that you know what the edge looks like and how to come back if you cross over, how do you stay on the edge? You've done all of the hard stuff already, so this is relatively easy. What you're after is being able to fly as close to the edge as possible without crossing over because once you cross over, the recovery will usually negate any gains that you have or might have made up until that point. In a nutshell, fly right up to the start of the buffeting and let off; then try and keep it as close as possible. This isn't easy to do because it requires precise control. Then again, if it were easy to do, everyone would be doing it. This is where to gain the advantage over your opponent(s).

Trim Your Nose

What *Pacific Air War* calls Nose Trim is more commonly referred to as elevator trim today. While it is possible to successfully fly a combat sim without ever using it, there is a combat advantage to learning it, which is very simple, but inexperienced pilots usually have a hard time using it—because no one has ever told them that a trim tab setting only works for the particular airspeed that it was set at. For example, in *Pacific Air War*'s setup your airplane is flying level. Hold the joystick exactly where it has to be to remain flying level. Wait a few seconds until the airplane has finished accelerating or de-accelerating. Now press the N key. Your trim will remain steady until you change your power setting, change flight attitude, or you bank.

So, what does this have to do with air combat? Well, it really comes in handy when you switch to views such as the Virtual Cockpit Mode (VCM) in *Pacific Air War* because your joystick can only work in either flight or VCM mode at any one time. By properly setting your elevator trim you'll be able to stay in VCM long enough to comprehend what you're looking at instead of having to flip back and forth between modes faster than the flicker of an AVI file. Keep the pointy end toward the sky!

TURNING

One of the most important things you'll ever do in an airplane is turn it. There are basically two ways you can execute a turn in an airplane: as a precision turn or as a non-precision turn. Just as the name indicates, a non-precision turn is a turn that is not precise in regard to bank or rate. Generally, these can range from the leisurely *sight seeing* type of turns to the *bank and yank* (while reciting a quick prayer) turns that are made in desperation when trying to evade a bandit on your six.

On the other side of the spectrum is the precision turn. While a precision turn is commonly thought of as the standard rate turn used in instrument flight, in the world of veteran air combat pilots, the combat turn is also a precision turn. What we're talking about here isn't so much the mechanics of how to make a turn, but rather how a turn is executed.

How Real is Real?

It's important to remember that this chapter's discussions of intermediate and advanced topics apply to real-world physics and aerodynamics. However, because you're dealing with *only* flying simulations here, the effectiveness of the tactics and skills are only as useful as the physics your particular sim world provides. On the other hand, understand that this in no way negates the importance of these topics for a couple of reasons. One is that if your sim does mimic the real world closely in some or many areas, understanding what is actually happening can help you gain an advantage over your opponent. Secondly, flight and air combat simulation developers are on the bleeding edge of sim technology, and sim software developers are in competition to make sims as realistic physics-wise (and graphically for that matter) as possible. So it's just a matter of time before *all* of this real world stuff becomes extremely important.

Lift and Stall Review

To understand what happens in a turn, you first need to understand how lift is generated to make a wing fly. On an intermediate level, just recall that a stall occurs when a wing exceeds the critical angle of attack regardless of airspeed. What you need to consider is that an airplane can only lift a certain amount of weight due to wing design, power plant, and atmospheric conditions. However, the pilot can, to a limited extent, make up some of the lost lift by increasing the angle of attack or adding flaps. (Good to know!) Also, wings will stall at a higher speed when an airplane is heavier. This is because extra angle of attack is required (bringing it closer to the critical angle of attack) to produce the additional lift to compensate for the heavier load.

Lift and the Turn

The reason why lift is so important with regard to turning is because for an airplane to fly straight and level, a wing needs to generate 1g of lift to offset the weight of the airplane (see Figure 1.1). We know while rudder turns are possible, an airplane must bank in order to turn regardless of what control surface provides the banking action. Generally, the steeper the bank, the quicker the turn. However, when you bank an airplane, only a small percentage of the wing can generate lift in the required direction to offset the weight of the airplane. This results in a loss of altitude. To counter this you must increase lift by increasing the angle of attack (pulling back on the elevator). An airplane in a 60-degree bank requires double the lift to maintain a level turn. (The cosine of 60 degrees is 0.500 or 50 percent.) To further complicate things, certain variables/conditions affect lift.

Airspeed vs. Radius

Just as when you drive a car very fast into a turn, the radius of a turn will be larger than if you took the same turn at a slower speed. This is because the effects of centrifugal force become greater than the centripetal, or holding force that is created by cross component of lift when the airplane is banked. Without getting bogged down in a physics discussion, centrifugal force is explained by Newton's first law of motion that states "a body in motion tends to remain in motion at a constant speed in a straight line unless acted on by an outside force."

To go back to the speeding car in a turn example, the force acting against the forward motion of the car is the driver turning the steering wheel, which in turn, turns the front tires (centripetal force). Centrifugal force causes the car to continue going

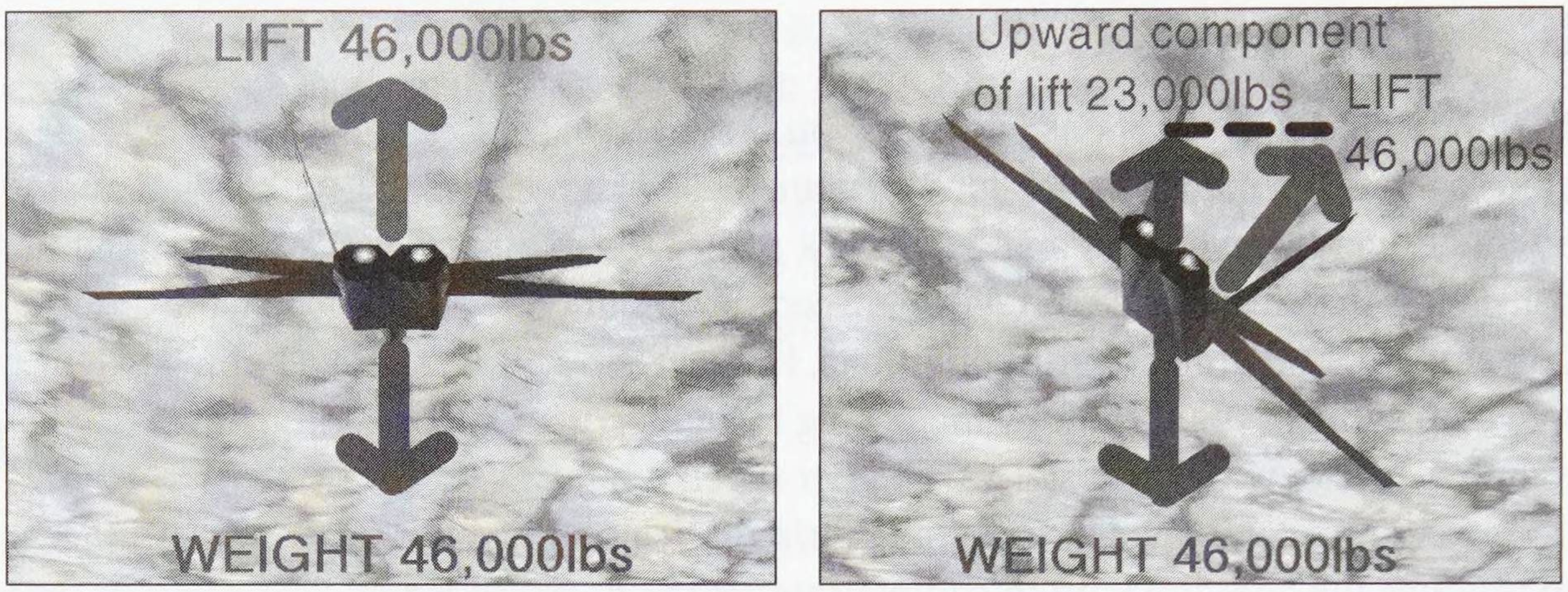


FIGURE 1.1: In order to maintain level flight, lift must equal weight; when the airplane banks, the lift vector banks, resulting in a loss of upward lift and altitude.

straight even though the front wheels are turned. Now, what is important to note is that the faster you make the turn, the greater the centrifugal force. If you continue to increase your speed in the turn, there will come a point when the centrifugal force that wants the car to continue straight will exceed the tires pushing (centripetal force) the car into a turn. This will increase the turn radius. However, as you may well know, this will only continue to a point. Tires generally have a traction curve that peaks and drops off very sharply. This results in a loss of control at the end of the car where the tires go over the traction curve peak (spin).

In airplanes, centripetal force is created by lift and control surfaces. Just as with car tires, control surfaces have lift curves that are somewhat similar—they gain and drop off after the maximum lift peak. Now some wing designs drop off sharper than others, but nevertheless, when they drop off, they result in lower lift and stalls.

Airspeed vs. Rate

Turning rate is the time it takes to move the nose (it could be any other part of the aircraft, but general conventions reference the nose) of the aircraft a certain number of degrees. It is natural to reason that by going faster, you'd increase your rate of turn due to the increase in lift gained with the additional airspeed. However, when you consider the maximum lift curves just discussed, going too fast will also result in a decrease in turn rate because of losses in lift.

Altitude vs. Lift

You may have discovered this yourself in sims that model altitude effects, but altitude affects lift. Leaving engine power losses due to altitude out of the equation, basically, the higher you fly, the less dense the air becomes, and the less dense the air becomes, the less air there is to create lift; so turn performance suffers.

Temperature vs. Lift

While most sims do not model air temperature effects (that may change in the near future), warm air means thin air, and cold air means denser air. Just as always, dense air means better lift.

Altitude and Temperature

As you increase your altitude, the air gets colder. This is because the sun heats the earth and the ground heats the air. So the farther you move away from the earth, the less heat is transferred. But wait a minute! Doesn't the air get thinner as you increase in altitude also? Yes it does, and it can really complicate things on very hot days.

Cornering Speed

Okay, so turn rate and turn radius both decrease with airspeed. As combat pilots, we want maximum turning performance. This is achieved with maximum turn rate at the minimum turn radius. Since turn radius increases with speed, this translates into maximum turn rate at minimum airspeed. Pilots call this magic number *cornering speed*. Cornering speed is not an absolute airspeed number that works in all situations even in the same exact aircraft. It's a *moving target* that is dependent on the lift variables just discussed. You should also note that the maximum turning performance achievable from cornering speed maneuvers are also affected by these same variables.

Unless your sim provides an altitude sensing corner velocity indicator like *US Navy/Marine Fighters* provides on their aircraft HUDs (see Figure 1.2), the only way most of us will be able to get cornering speed information is if the sim manual provides it. If not, you'll either have to spend a lot of time flight testing your aircraft to figure it out or talk to someone who already has. Using flight performance tables from actual aircraft can help, but as always, they're only as good as the implementation of them in the sim.

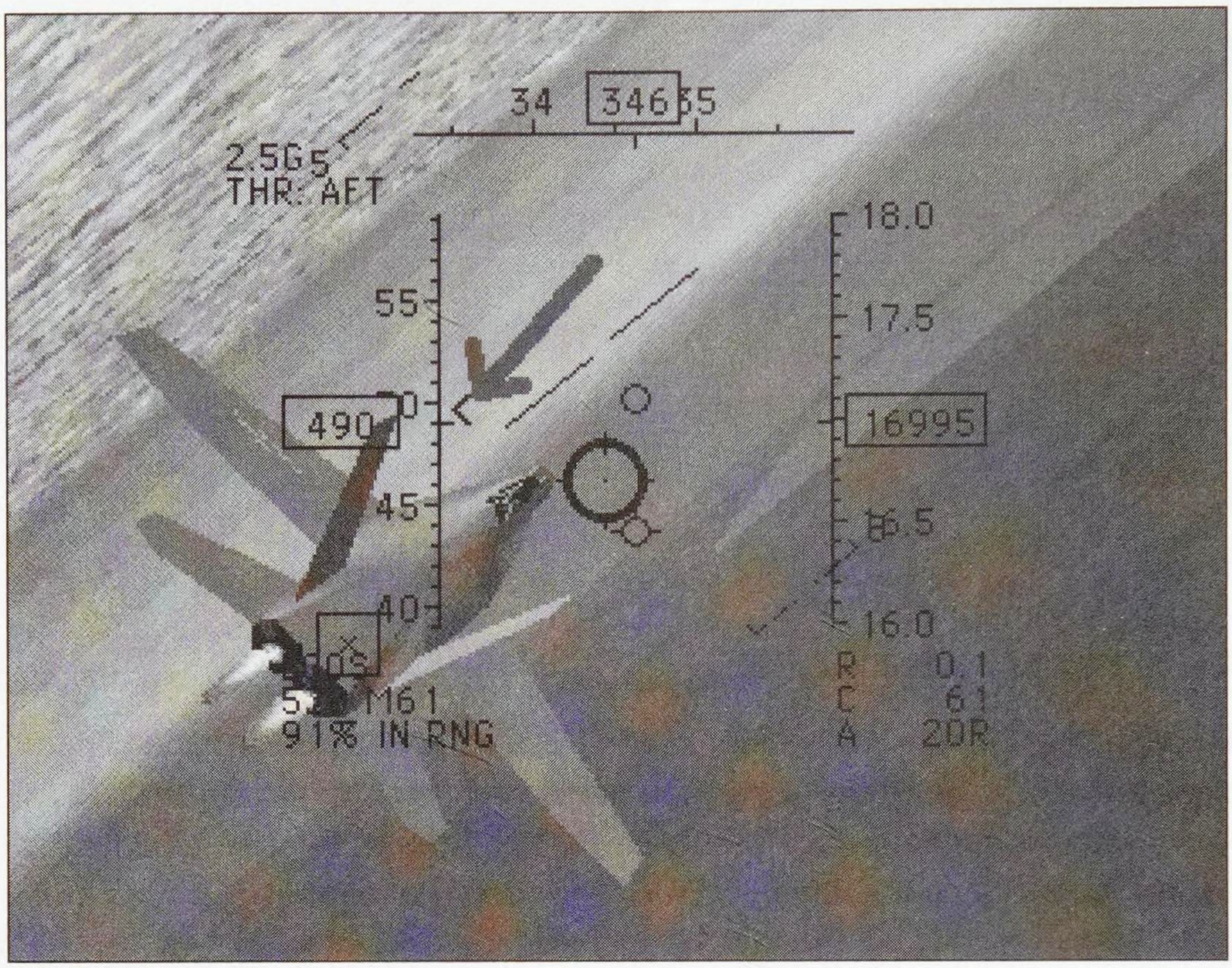


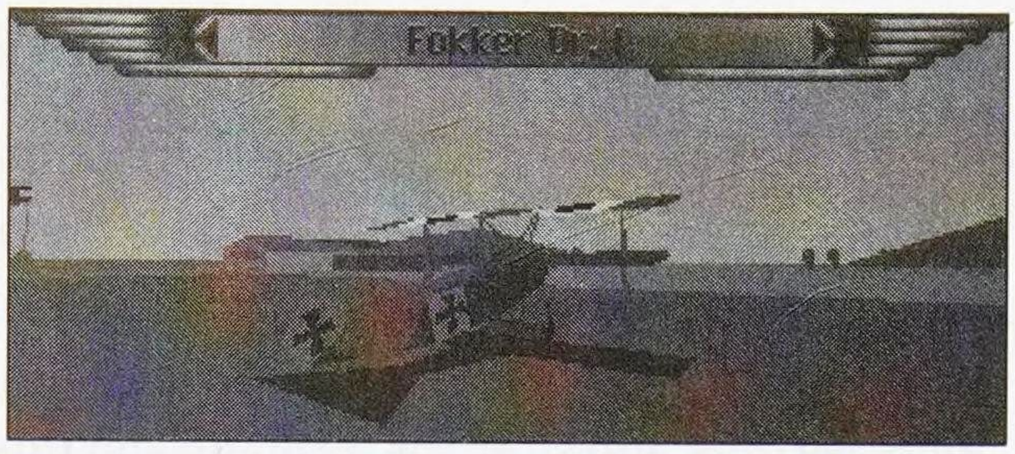
FIGURE 1.2: *US Navy/Marine Fighters* provides an altitude sensing corner velocity indicator in their aircraft HUDs.

Airspeed vs. Lift

As was mentioned previously, lift is a critical component for turning, and lift generally increases with airspeed. However, higher airspeeds increase turn radiuses, which in turn, will decrease the turn rate. Even though lift generally increases with airspeed, we attribute these contradictory effects to centrifugal force and lift limitations. Technology has lessened these limitations but at the same time created others.

Lift vs. Structural Limitations

As high performance fighters moved toward an abundance of power and more efficient lift devices (wings and fuselages), structural integrity became a major lift performance limitation. Structural failures are every bit as limiting as lift failures, but are more dangerous. The difference is that you can recover from a lift failure. Structural failures can't be repaired in flight and are fatal sooner or later in most cases.



Fortunately (or unfortunately), advancements in materials technology have lessened and eliminated these structural limitations to the point where the pilot has become the turn performance limiting factor. While there are some who feel that in the future fighters will need to become unmanned remotely piloted vehicles in order to maintain *bleeding edge* performance, it's unclear where that will lead the flight sim world. On the bright side, there have always been historic flight sims, and they'll most likely continue well into the future regardless of what the real world ends up doing.

Weight vs. Lift

Whether your lift generating capabilities are limited by aerodynamics, brute horsepower, materials and construction, or human physiology, your aircraft's overall weight greatly affects your turning potential. Again, this directly relates back to lift. The heavier your aircraft, the closer you'll be to your lift, power, and structural limits. There are two additional reasons for this that have yet to be discussed in this chapter and both are due to drag.

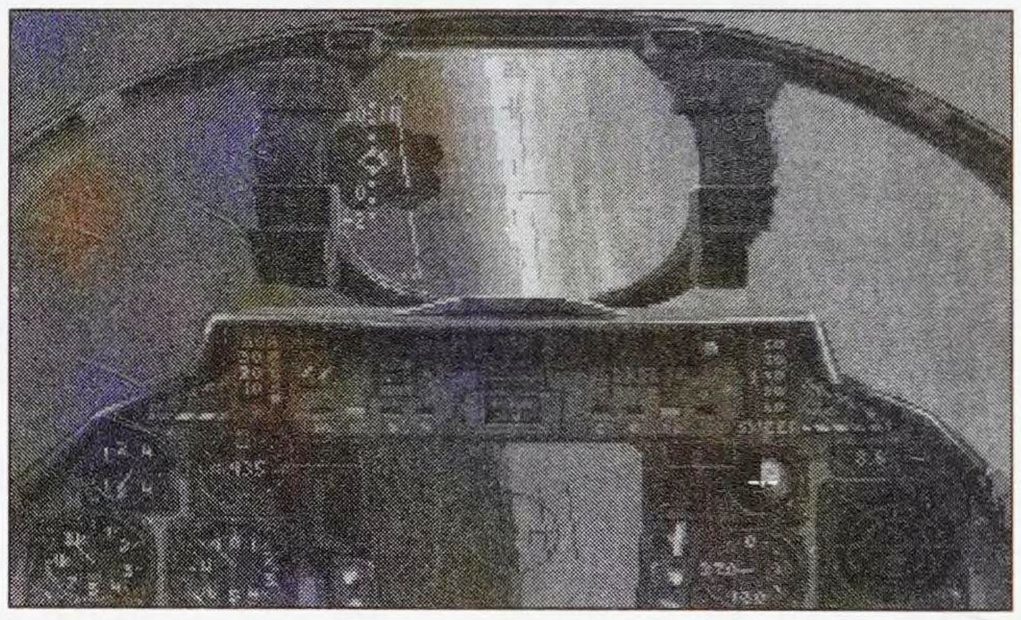
First, extra weight requires additional lift, and additional lift creates additional drag (*induced drag*—drag created by lift). The other is when you fly around with external fuel tanks or weapons. These create *form drag* (a type of parasite drag created by the additional frontal area of the structure that has to push additional air out of the way). Regardless of how it is created, it affects your aircraft the same way; it drains your performance potential by placing you further up the performance curve than you want to be.

While there isn't much you can do about additional aircraft weight not attached to a hard point on your aircraft (you can't remove stuff from your cockpit and eject it out your canopy in a sim), you can drop external stores and auxiliary fuel tanks. While it has been standard practice since World War II to drop external fuel tanks before battle, many sim pilots are successful without doing so. However, experimenting during combat can be fatal. Because you're flying sims, however, you can experiment and only risk minor damage to your ego.

Instantaneous vs. Sustained

Turn rates can be classified as either *instantaneous* or *sustained*. Just as you'd imagine, the difference between the two is the period of time they're able to maintain that rate. While you can achieve a high instantaneous G-load by yanking on the stick, you won't be able to maintain that high rate for very long, because that high G-load will increase drag and slow the airplane and thus reduce the maximum G obtainable. Conversely, a lower G-load produces less drag. Eventually you'll reach a point where thrust will be sufficient to overcome the drag being produced. This will allow you to maintain the current G-load and speed. This is called sustained turn rate.

Many sim pilots rely on an aircraft's sustained rate performance figure and basically ignore the instantaneous turning ability. They do this because an aircraft with a high sustained turning rate will be easier to fly in combat, but ignoring instantaneous turn rates is a mistake. A superior instantaneous turn rate can be very useful for defensive maneuvering and missile spoofing, but when used effectively, it can also be very deadly. This advantage can allow you to come to a weapons solution faster, but the downside is if your sustained turn rate is inferior, unless you make the kill immediately, you're in for trouble. It is exactly at this point that illustrates why a superior sustained turning rate aircraft is easier to fly; it is more forgiving—in this case, when your marksmanship isn't superhuman.



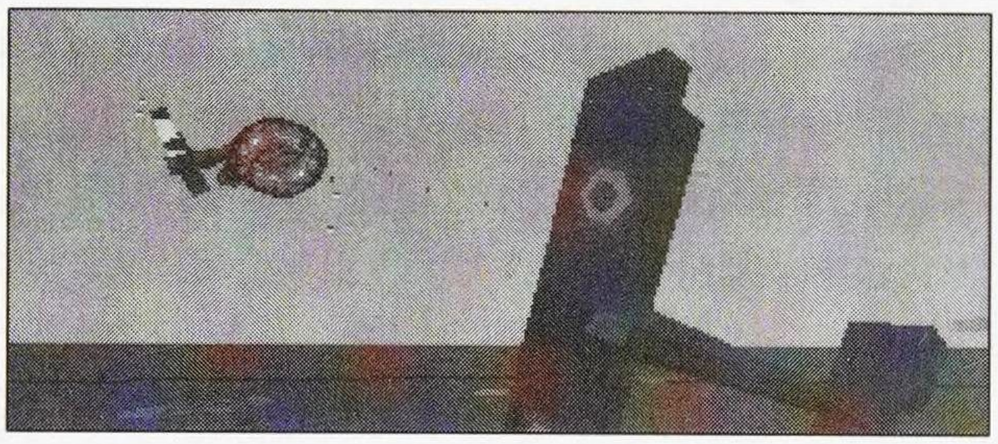
INTERMEDIATE MARKSMANSHIP

Learning to make gun kills is really learning to fly. As you know, as an air combat pilot, among other things, your job consists of flying your aircraft to a favorable position so you can fire your weapons at your target. Of course, there are favorable positions and there are more favorable positions. Knowing just what is a favorable position depends on three things: what you're shooting (your weapon), what you're shooting from (your aircraft), and who you're shooting at (your target). Good marksmanship is sometimes

described as *shooting well*. As you're about to see, the previous three criteria are the backbone of good marksmanship.

GUNS! GUNS! GUNS!

The gun and the cannon have been primary air combat weapons since the beginning of air warfare and remain so to this day. There was of course the exception during the Vietnam era when someone decided that the F4 Phantom did not need a gun. It was reasoned that because the enemy would be killed at long range with the Phantom's missiles, a gun wouldn't be necessary. Looking back, we now know what a mistake that was. While missile deployment technically falls under the category of marksmanship (after all, it's just a big, self propelled, and sometimes smart, gun round), it really deserves a separate discussion.



In the days before lead computing gunsights became available (around the middle of WWII), pilots relied on their skill and experience to mentally figure out how much lead was necessary to get hits on their target. Most prop-based air combat sims model their aircraft with non-lead computing gunsights, so you are left with the same task. While this isn't too difficult to learn; following is some information that will help you increase your hit ratio (bullets that hit compared to bullets fired).

Convergence Divergence

On a fighter guns are generally mounted in one or two of three possible positions. These positions are on the nose, fuselage, or wings. A nose-mounted gun poses the least amount of computational problems, and wing-mounted guns pose the most. This is because a nose-mounted gun generally fires straight in front of your aircraft, and wing-mounted guns are usually set so their line of fire converges somewhere out in front of the aircraft. Naturally, where this convergence point is located is very important because your greatest fire and killing power is where these two or more bullet streams meet. But more importantly this gives you a way to know exactly where your bullets end up when you pull the trigger. This can range from as little as 75 feet to greater than 400 feet. Unfortunately, these ranges vary from aircraft to aircraft and from sim to sim with the same aircraft.

Here is the way to figure out the convergence patterns in your sim and aircraft. While on the ground or flying level, switch to an overhead, external view. Fire your guns and see where your bullets converge. You may have to zoom out the view to see this point. Next, based on the wing span of your fighter, you can roughly estimate how far ahead of you the convergence takes place. Most WWII fighters have wing spans of about 35–40 feet. This means that if your bullets converge about three wingspan lengths in front of your airplane, you can figure the distance to be about 105–120 feet.

Size Up Your Target

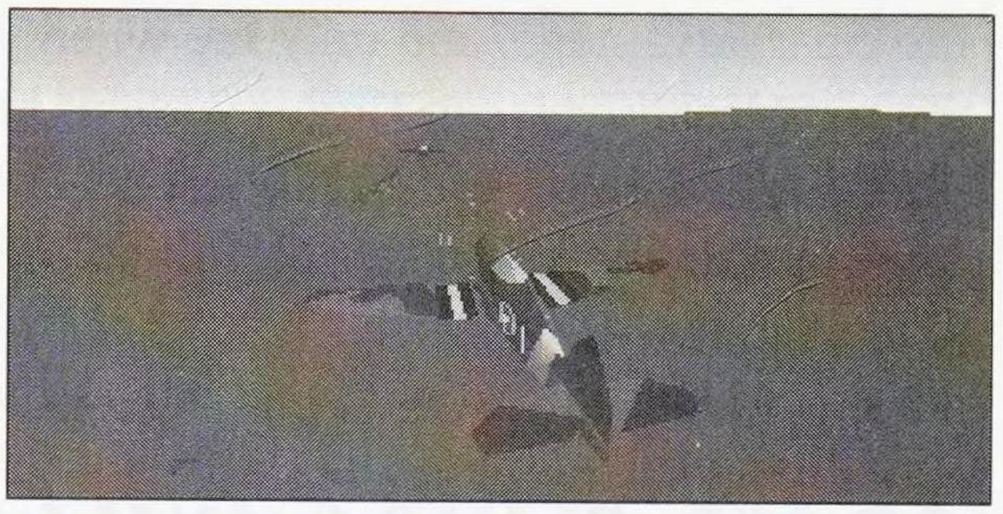
Knowing exactly where in space your six .50 caliber machine gun bullet streams meet is good, but be aware that wing-mounted guns cause another problem. You have to worry about your distance from the target as well as the angle off the lead. The way to judge distance is to use your gun sight. Again, while on the ground or from level flight, line up a known airplane in your sights. Switch to the external, overhead view to make sure it is in your kill zone. Switch back to cockpit mode, and note how much gun sight is taken up by an aircraft at the gun's optimum killing range. Once again, this can vary from sim to sim, so you'll have to do some of your own exploration.

If wing-mounted guns pose so many problems, why were they so widely used? The design choice was mainly due to the big props found in this era. While the technology for timing the guns to fire in between the prop blades existed, timing for four or six guns became a bigger problem. Other reasons included the desire to carry lots of ammo. Stuffing six guns with a large load of ammo and a big engine in the nose of a fighter just doesn't seem practical. Attempts were made to get around these problems with the P-39 Airacobra. It had a gun that fired directly through the prop shaft. What facilitated this design is the fact that the engine was mounted behind the pilot! Nevertheless, the whole design was only marginally successful, thus wing-mounted guns flourished.

Aim for the Right Place

Firing at the right distance and lead angle isn't always enough. You still have to aim for the right areas on your target to get good, fast kills. For instance, you can empty all of your guns into the tail of most aircraft and only get some smoke out of it. It'll continue to fly and generally make a nuisance of itself. This is because sim flight models have hit areas modeled as well. Certain areas of an aircraft correspond with greater hit values. To find out where they are, you have to shoot some planes up. The best

way to do this is shoot from a gunner position in a dive or torpedo bomber. You'll usually notice that hits anywhere other than the engine will not result in much damage. This includes shots directly at the pilot. So you must always aim for the engine because every sim rightfully models this as a critical area.



Lead Computing Sights

Most modern-era combat sims model lead computing gun sights. There are generally two types modeled. While both use a Continuously Computed Impact Point (CCIP) display in the Heads Up Display (HUD), how you use them differs. The easiest to understand and use is the aiming reticle. This type is found in most sims. Just put the *death dot* on your target and pull the trigger. Simple. The other type is aiming funnel, like the one found in *Falcon 3.0*. This display computes the bullet path while supplying range information. The wide end of the funnel is closer to you, and the narrow end is further away. The trick to using the funnel is to line up your target, pull the trigger, and sweep the funnel over it by pulling the nose of your aircraft over the target.

Staying Alive

Shooting like an Ace is all fine and dandy, but a few words about how not to get shot to pieces when doing so is in order. Recall the four possible relative positions two fighters can have with each other in descending order of danger: T2H (Tail to Head), H2H (Head to Head), T2T (Tail to Tail), and H2T (Head to Tail). Obviously, it is easier and safer to shoot at a bandit when he can't get any shots off at you, as in a H2T situation. Because they'll usually want to shoot you out of the sky also, that scenario will be rare. It is more likely that you'll be faced with making T2T or H2H shots. Generally, the odds are that you'll live longer if you try and avoid the H2H shoot-outs. This means you'll be making mostly T2T high angle of deflection shots. Master them and you will be feared and respected.

Hit Ratio

The most sure-fire way to increase your hit ratio is to follow the advice of Manfred von Richthofen—a.k.a. The Red Baron. His philosophy was to only attack when you have

the clear advantage, and only fire when you're sure you'll get a hit. While this may seem cowardly, you can't argue with his kill record (80 kills). In practice, this is a very boring way to fly air combat sims. There's nothing like getting in the middle of a scrap that you think you may not be able to survive and coming out victorious. That's the kind of stuff we live for, right! So go for it!

ADVANCED FLYING SKILLS

Top flight performance can directly be attributed to a pilot's skill and thorough knowledge of the aircraft. Naturally some aircraft perform better than others, but it takes skill *and* knowledge for a pilot to extract every ounce of capability from any aircraft. It is hard to quantify exactly how much of a pilot's ability comes directly from what he knows and how much comes from pure skill, but no one disputes that truly great piloting skills cannot be developed without knowledge.

NOTE

Be aware that a lot of what is covered in these Advanced Flying discussions is only applicable to sims with more accurate/realistic flight models.

Studying the flight characteristics of a particular aircraft is without a doubt beneficial; however, it is also very advantageous in the long run to discuss flight aerodynamics in general. Once you understand flight theory, understanding the flight characteristics of a specific airplane becomes very easy to comprehend. Knowing how and why things happen gives you the knowledge to exploit them or avoid them if possible.

AIRSPEED VERSUS CONTROL

You've probably noticed that when you're flying at a low airspeed, your flight controls become less effective (mushy). This is because low airspeed causes the decrease of airflow over the control surfaces. As your airflow decreases, more control deflection is required to divert the same volume of air.

On the other hand, as your airspeed increases, the amount of control input required for maneuvering decreases. However, this trend only continues to a point. As you approach the other end of the flight envelope your controls become *heavier* and less effective again. Depending upon the aircraft design, you may actually lose all control (that is if your aircraft doesn't break apart first). What causes this is known

as *compressibility*. Lift is generated by airflow moving faster over the upper portion of the wing than the bottom (Bernoulli effect). When you start flying very fast in a non-supersonic aircraft (forced in a dive), the airflow going over the top of the wings reaches Mach One (speed of sound) and travels faster than the airplane itself. This supersonic flow produces a strong shock wave that leads to the separation of the boundary layer (layers of air that flow near the surface) causing the loss of control authority.

The actual point that compressibility occurs varies due to wing designs. A high lift wing will enter compressibility before a low lift wing. For example, the high lift wing of a P-38 (which was designed as a fighter bomber that could haul a bomb load equal to a medium bomber) will enter compressibility at Mach .67 while a Spitfire encounters compressibility at Mach .82.

Even though being equipped with this type of information will help you fly out on the edge, it is probably more advantageous to learn the specifics about your enemies' limitations in comparison to your own. This would help you decide on a basic plan of attack to exploit your strengths against your opponents weaknesses. Just keep in mind the overall effects of airspeed and airflow over the control surfaces.

EXCESSIVE TOP RUDDER STALL

Recall that stalls occur when there is a lack of airflow over a flying surface. In the case of the *top rudder stall* your nose drops so more elevator is applied. Airspeed continues to drop causing the nose to drop further. For example, if you need to make a hard turn to the right, banking will expend energy that causes your airspeed to drop. To counter this, some pilots apply opposite rudder (left rudder in a right-hand turn). As mentioned earlier, as your airspeed drops, so does control authority, so even more elevator is applied. This causes airspeed to drop even further yet.

If you look at the control surface of the high wing aileron, you can see that the aileron is deflected downward at a higher angle of incidence than the wing itself. Increased incidence will produce more lift and, thus, give the airplane the rolling moment it needs as long as the wing itself is below stalling angle. When banking to the right, your control input is asking the left aileron for more lift. Trying to get more lift from a wing that is already giving its all, as in this example, will force it to stall. The stall produces a lot less lift and a lot more drag, which in turn produces a roll in the reverse direction—dropping the high wing. Other factors that contribute to this type of stall include *skidding* or *slipping* from the application of left rudder, which causes the interference of airflow over the high wing by the fuselage. (With a prop in the right bank example, *engine torque* and *P-Factor* are also factors.)

SPIN AGAIN

As you know, spins are the result from one wing generating lift while the other is not. In a clockwise spin, the port (left) wing is generating lift, when the starboard (right) wing is stalled. When standard spin recovery is insufficient to restore airflow over the stalled wing, causing the flying wing to also stall can aid in spin recovery. When both wings are stalled, you are just faced with recovering from a standard stall. The way to do this is to apply opposite rudder (in our example this would be left rudder) and right aileron. Look familiar? That's right, it's our old friend the excessive top rudder stall. Although you'll want to neutralize the elevator to eliminate re-stalling the already stalled wing, it is sometimes helpful to apply full down elevator in addition to aileron movement. It can sometimes quicken your recovery, but this is dependent on your particular aircraft and flight model and spin, so you'll have to experiment—hopefully not in the heat of battle.

Energy Management

A fundamental air combat rule of thumb for energy management is *speed is life*. Energy management also tells us that altitude can be traded for speed; thus, altitude can be considered life also. However, it isn't very widely discussed that in non-normally aspirated aircraft, altitude gains power and performance. (This is why most flight performance envelopes are slanted near the top.) As altitude increases, so does airspeed and range. This only happens up to a point, and it complicates things, but it probably explains why this concept isn't conveyed with a catchy phrase like *speed is life*.

As you fly higher into the atmosphere, the air becomes thinner and normally aspirated aircraft engine performance decreases. As the air thins, the maximum engine compression obtainable becomes lower. While supercharged, turbocharged, and turbine jet aircraft can delay the thin air problem, none eliminate them totally. Again, this is why flight envelopes vary for different aircraft. By delaying the loss of engine power, you are able to make gains on the thinner air.

Thinner air means less drag, which means higher airspeeds. If speed is life, this is an advantage. Also, even though prop air combat sims don't make you adjust fuel mixtures, in real aircraft, thinner air allows you to lean out your fuel mixture. This allows you to conserve fuel and increase your total range. While a sim may not require you to make fuel mixture adjustments, you will reap benefits just the same. Faster speed for the same power equals more distance. Another feature of the atmosphere is that as your altitude increases, the temperature decreases. Although it's not clear if any

sims model this, it is worth noting. Cooler ambient air temperature keeps your engine cooler and provides a better *charge* for engine power.

AIR COMBAT BASICS: CLOSING

The five stages of air combat are Detection, Closing, Attack, Maneuver, and Disengage. In air combat terms, the Closing stage doesn't signify the end of the battle. It fact, it is just the opposite. This is really where the battle begins. Closing means getting closer. The transition from Closing to Attack is determined by weapons range. The Closing stage is very important. Making wrong decisions here at the beginning of the battle can severely hinder a favorable outcome to the engagement.

Whether you've identified the second and/or third of the three Ws (where, what, and who) as Pilot In Command (PIC), you have to make an assessment of your present situation and mission goals. Even though both situation and mission goals are separate criteria, both must be considered to make a good Closing decision. This is why we'll cover each individually. But first we should lay out some basic ground work since things happen pretty quickly from here on in.

NOTE

Unless you're flying with foolproof, working Identify Friend or Foe (IFF) equipment and radar, closing on a bogey (unidentified aircraft) is the only sure way to find those last two Ws—what and who.

HEADS OR TAILS

Fighters are basically flying weapons platforms. Continuing with the high-performance props example, the nose of a fighter is the most dangerous end of the aircraft. All areas are vulnerable; however, the most vulnerable is usually the tail. With this scenario, you have four possible situations. In the order of the most desirable to the least desirable, you have H2T (Head to Tail), T2T (Tail to Tail), H2H (Head to Head), and T2H (Tail to Head). The convention is your airplane's first in relation to the other airplane. In a H2T situation, for example, the Head or nose of your aircraft is facing any other part of the other aircraft other than the nose. While some pilots would place H2H as more desirable than T2T, the hierarchy is based on danger to you, not offensive ability.

OFFENSE OR DEFENSE

Next, it is important to categorize each as either offensive, defensive, or both. Yes, some situations can be both offensive and defensive at the same time. Some tacticians would categorize those situations as neutral, but I see them as being both offensive and defensive. Anytime your opponent has his nose pointed at you, you are defensive. Anytime your nose is pointed at your opponent, you are offensive. Thus, in the case of an H2H relation, you are both offensive and defensive. A T2T orientation is categorized as neutral. Naturally, all of these are based on the assumption that both parties have ammunition. Range also plays a big role. If both of you are outside of weapons range, these don't apply.

SITUATION RELATION

Closing takes place outside of weapons range. If you're already offensive or defensive, you've jumped to the Attack or Maneuver stages, so let's back up. When faced with a Closing situation, you must decide two things: If and How. In the case of the If part, your decision on whether to proceed to the Closing stage can be based on your current condition. If you are low on things (ammo, fuel, and/or airplane parts), you may want to make a break for home, in which case you'd jump directly to the Disengage stage. However, it should be noted that your current situation can be directly related to your enemy's current situation also. If it's just you and your wingie versus a squadron, you may decide that mixing it up with them would be more challenging than your aircraft could handle.

MISSION SPECIFIC GOALS

Your mission goals will also dictate whether you'll even want to proceed to the Closing stage. For example, if your primary objective is to bomb a target, you may choose to hit your target and deal with air threats later. With more traditional fighter missions such as CAP, Sweep, or Escort, your situation has more bearing on whether you'll proceed with Closing. In all traditional fighter missions, if you can fight, you fight. It's a no brainer. (Besides, running away isn't much fun.) This brings us to another of many *rules of thumb* that will be passed along throughout this chapter: *Be aggressive*.

The old cliché, "the best defense is a good offense" applies in air combat. By being aggressive and taking the initiative, you can force your opponent to take a defensive posture. This puts him in a bad position and you in a good position simply because,

if your opponent is defensive, he can't shoot at you. Some people argue that being so aggressive is unrealistic. Because we fly sims and aren't putting our real lives on the line, we fly without realistic concerns of personal safety. While this is of course true, from what you may know or have read about real fighter pilots, they make every attempt not to think about getting killed or shot down. Thinking about it hinders your performance and abilities. The best real fighter pilots are aggressive, and the more aggressive they are, the higher their kill ratios.

Be aggressive and take the fight to your enemy. This will give you maximum separation from the asset you're protecting or put you closest to the target your trying to take out. But keep in mind, *aggressive* doesn't necessarily mean *suicidal*.

POSITION MAGICIAN

This brings us to How. Naturally your current position in relation to your enemy/target will dictate your Closing strategy. While the traditional, time- and battle-tested approaches still apply, advanced modern fighter aircraft have rendered some of them as relatively unimportant. Therefore, those flying under powered WWI aircraft can make the best use of this information.

PASSS

Position, Altitude, Speed, Surprise, and Sun (or PASSS—this little acronym says it all). A good way to remember PASSS is to think of air combat starting with "a first PASSS." Individually, each element yields its own advantage, so the more of these you can achieve, the greater your advantage.

Position and Surprise

For *position* against fighters, you want to gain a position in the order of preference discussed earlier, H2T, T2T, H2H, and T2H. Naturally, unless you can *surprise* (the second S in PASSS) your enemy, he will attempt to maneuver, so you'll gain as few advantages as possible.

Altitude: Taking the High Road

In the early days of air combat, the advantage of altitude was legendary. However, modern aircraft and weapons render this advantage to almost nil, but take it if you can

get it. Everyone knows altitude can be traded for speed, and speed can be exchanged for altitude. However, you should be aware of your aircraft's performance envelope. Altitude and speed can be a good thing, but there is such a thing as too much of either, which can eliminate your advantage. On another level, don't sacrifice too much of one for the other. Moderation might describe what you're after. Generally it's better to have a little of each than to be high and slow, or low and fast. There are of course exceptions to this, but for now, moderation is safe because it doesn't present any inherent disadvantages.

Fun in the Sun

Interestingly enough, the *sun* remains a significant tool even in the world of modern fighter air combat. It can be used in both offensive and defensive tactics. In an offensive capacity, use the sun to hide your approach. This can help you gain the element of surprise. This is pretty difficult to do, so don't put too much effort into it. However, if the luck of the draw puts you in a position where you're able to use the sun, take advantage of it.

FINAL CLOSING TIPS

Before Closing on the enemy, make note of the bearing of important waypoints and landmarks. Note where things are such as which way leads home, the locations of bombers, and the locations of targets. As was mentioned earlier, from here on in things get hairy. Better to get your bearings straight now while you're not being fired upon. It will save you from having to waste time and energy during battle just to figure out where things are.

AIR COMBAT BASICS: ATTACK!

The Attack stage follows the Closing stage. What separates the Attack stage from Closing stage is the proximity between you and the bandit. When you have reached weapons range and have working weapons and ammo, you've entered the Attack stage. Depending on which side of the coin you're on, this is where the fun begins or where the sweating starts.

KINDS OF ATTACK

Boiled down, there are really only two basic attack positions—H2H and H2T. Unless you're flying a Mig 29 with a helmet-mounted missile sight or a helicopter with a gun turret, the nose of your aircraft will always point at your opponent during attack because that is where your guns and other weapons fire from. Your target will face you with either its head (nose) or tail (other part of his aircraft). The distinction between head and tail is based on offensive capability. Anything other than the nose will be considered the tail since it can't shoot at you.

Naturally, the most desirable position is H2T because you're offensive and more importantly, your target is defensive (remember we're only talking about fighters here). On the other hand, H2H is dangerous because even though you're offensive, so is your opponent. You can be shot down.

Here's another rule of thumb: *never break off an attack once you've initiated it*. Once you're within weapons range, if you decide to turn tail and run, you'll be setting up a shot at yourself for your opponent. If you weren't sure you'd be able to fight in this battle, you should have figured that out earlier and avoided the Closing stage altogether.

Head-On

Taking out an opponent on a first head-on pass is exhilarating to say the least, but most of the time, it's like shooting craps, because you never know if you'll win or lose. When faced with an H2H confrontation, you have to make a decision to go for it, or try and avoid it. Each has its drawbacks. If you try and avoid the head-on, you become defensive. While voluntarily putting yourself in a T2H situation may seem like suicide, in some situations it is the only way to stay alive.

There are two situations where you may want to consider such actions. One is when you face superior marksmanship such as that found in the *Aces Of The Pacific* sim and *Aces Over Europe*. When faced with borderline *unfair* AI and the best you can usually hope for is a draw in H2H confrontations, going defensive is a good decision. The second situation is when you're faced with superior firepower such as when confronting a P-40 while flying a Zero. In either of these situations, going at it toe to toe will result in you going down in a ball of flames 70 percent of the time. If you do choose to avoid the H2H confrontation, you're jumping to the Maneuver stage.

Weave and Fire

The H2H attack is a "catch 22." In order for you to get the *best shot* at your opponent, most pilots fly a steady course relative to the target's position. While this will increase the likelihood of you pumping your opponent full of lead, unfortunately, it also increases the ability of your intended target to reciprocate the gesture. Conversely, if you fly a course that gives your opponent a difficult shot at you (a high angle of deflection shot), doing so makes your shot at him also more difficult.

So, what's a pilot to do? Well, by far the best and safest solution is a compromise. What you want to do is fly a weaving course en route to your H2H pass. Fly your pattern so the gun sight of your airplane crosses over the firing position of your target. When he's lined up, squeeze off a few rounds at him. The pattern you fly is totally up to you, but to give you an idea of what you want, try flying so the nose and gun sight draws a figure 8 around your target. This can give you twice the amount of targeting opportunities in addition to altitude and heading changes to complicate things for his shots at you. This technique will also reduce the likelihood of a head-on collision. Note that with properly executed weave and fire attacks, you may not get the spectacular *ball of fire* kills as often as when you've gambled on toe-to-toe fights, but your H2H survival ratio should improve.

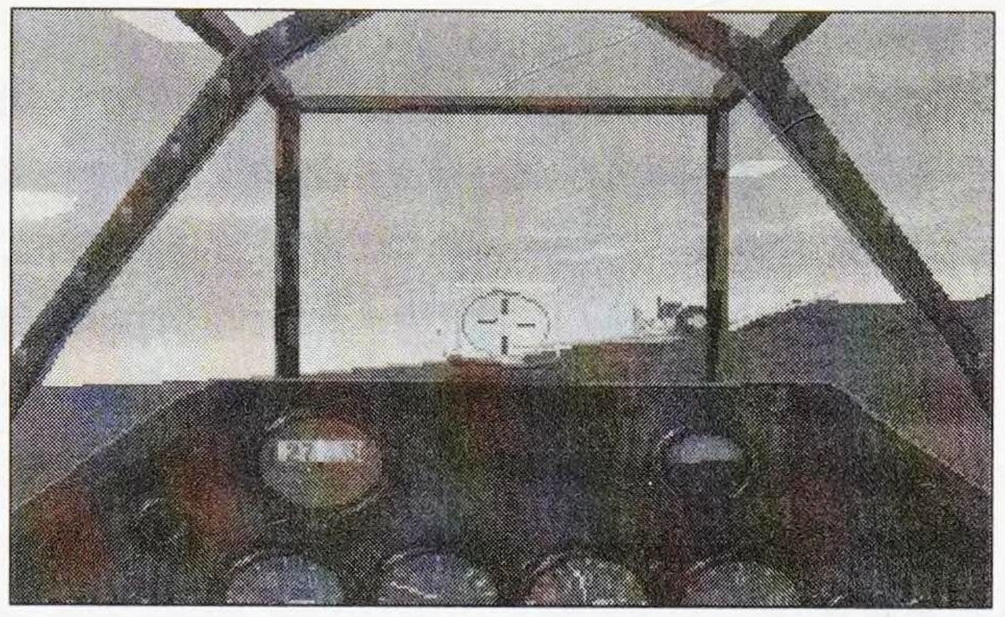
Attack from the Back

When attacking fighters, the preferred attack position is H2T. Naturally, when attacking bombers, that preference changes. While attacking unsuspecting fighters from the rear is the most desirable, you rarely get the opportunity for such attacks. The gun opportunities you're most likely to come across will require deflection shots. In either case, because the nose of your intended target is facing away from you, you're usually not in immediate danger (you're not dodging bullets). Therefore, go ahead and plant your gunsight on your target vector and keep it there. While this may sound like easy pickings, there are pitfalls to avoid with rear and flanking attacks.

Smash

Some armchair pilots would argue that the most common mistake that new pilots make when executing H2T attacks is flying too fast. While attacking with excess speed and energy (a.k.a. *smash*) can be a problem—especially in a rear attack where you whizz by your target and suddenly find yourself with him on your six—the problem is more in not knowing what to do with that excess smash. Flying at a very high

closure rate increases your chances of surprise and is desirable especially if you're utilizing *hit and run* tactics.



The other drawback (in addition to the rear attack problem) is high speed will increase your turn radius. How your aircraft performs will dictate how critical are these drawbacks. If your aircraft is a poor turner compared to your opponent's, slowing down so as to try and not over take him puts you in a bad position. You may get more rounds off at him, but if you don't kill him right away, you've bled off some of your energy and are now faced with a turning fight with you at a disadvantage.

You can try and dive away (to regain some energy and put some distance between you and him), but he'll most likely be able to squeeze off a few rounds at you. Even though this touches on the Maneuver stage and the Disengage stage, if you find yourself in a position where you'll be flying past your target, it's better to go punch the throttle and keep on going than to try and force a bad position. If you try and turn at a high speed, your turn radius will be large and will usually allow the bandit to pull lead and shoot at you. When faced with this scenario, just fly away and set up another attack run if you can.

On the other hand, if your aircraft is the superior dog fighter, you can bleed off your speed and engage into the turning fight with the advantage. Excess smash isn't as big a problem. So, if you're carrying excess smash, what do you do?

ENERGY CONVERSION

The best way to reduce excess smash is a simple E conversion—trade off speed for altitude. A popular choice is to pull back on the stick to slow down, roll over to point your nose at your target, squeeze, and kill. If you feel that pulling some Gs won't bleed off enough speed, reduce throttle or drop your air brakes, flaps, and gear, or do both (whichever your airplane will let you do). This will result in a net loss of energy, but it's worth it if it gets you the kill. However, keep in mind the proximity of other bandits. The trade-off may not be worth it if you're caught out of energy with that other bandit ready to pounce. It's better to temporarily save your skin and make more kills later in the battle than to sacrifice yourself for just one measly kill.

AIR COMBAT BASICS: MANEUVERING

The reality is that air combat is fought in horizontal *and* vertical planes. (See Figure 1.3). Technically, there is a third plane, a combination of the first two called the *oblique*, but for the sake of simplicity, let's focus on vertical maneuvering. In addition, the emphasis here is on piston-driven prop airplane gun combat. You can also add jets to the list but not missiles. If you add missiles into these vertical maneuvering discussions, some of this can get you killed.

E IS FOR ENERGY

A discussion about vertical maneuvering would be futile without some sort of discussion on energy (E) management. Especially in (relatively) low-performance gun fighters, E management is the most important concept or skill an air combat pilot needs

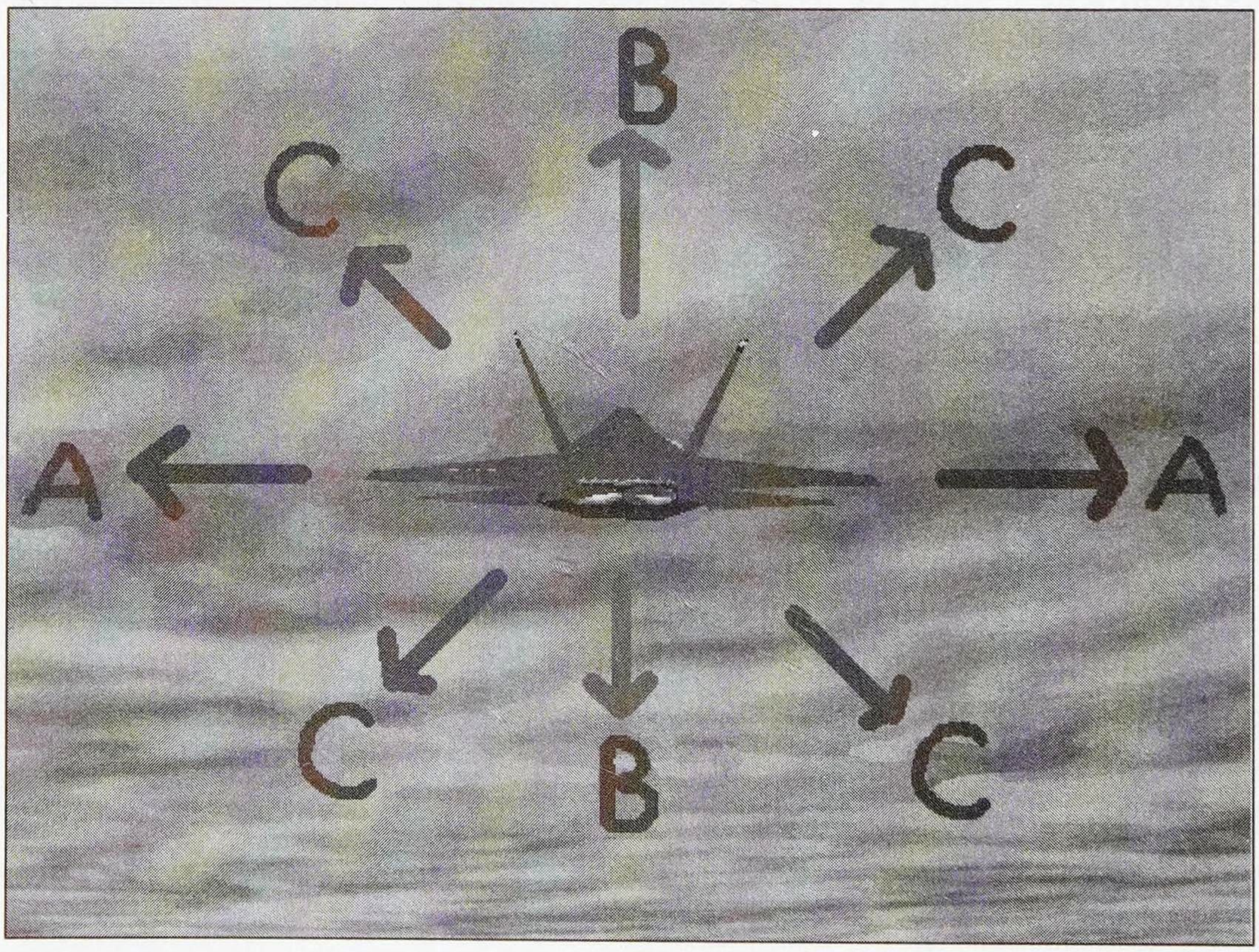


FIGURE 1.3: Air combat is fought on horizontal (A) and vertical (B) planes. There is also a third plane called the *oblique* plane (C).

to learn and fully understand. E management skills (conservation and expenditure) are what separate the Aces from the *target drones*.

So what exactly is E? Well, E is classified as either potential energy or kinetic energy. Kinetic energy is your airspeed; potential energy is your altitude. You convert potential energy into kinetic energy by diving, and you convert kinetic energy into potential energy by climbing. While they both may seem of equal importance—because each can convert itself into the other—in the grand scheme of air combat, potential has the edge *most* of the time. If you have a massive amount of kinetic energy (airspeed), that energy can only get you back up to a certain level of potential energy. For example, if you dive from 30k feet all the way down to 15k, you'll achieve a very fast airspeed; however, it'll only allow you to climb back up to, say, 25k before you end up going below your original (starting) airspeed. Thus, you've lost 5k of E.

Relativity of E

What is the relevance of E to your sim? How important your E skills will be depends on how good the flight model is, the characteristics of the planes being flown, and to a certain extent enemy AI. If your sim aircraft doesn't bleed airspeed and climbs like a rocket, much less of this information will be very important. Likewise, technology minimizes the significance of E management as well. With a modern high-performance jet aircraft such as the F-15 (which can accelerate through Mach while going straight up), the importance of E management becomes smaller—but this isn't to say that high-performance jets can neglect E management altogether. Not at all. Having an abundance of power will make most casual pilots sloppy. Therein lies the advantage of good E management skills.

E Tips

E can be airspeed, altitude, or both. At max throttle, the only way you can increase speed is to dive, but in order to dive you must have some altitude. While you can trade one for the other, the maximum total you can achieve is relative to the E you posses at that time. Altitude will get you airspeed, and airspeed will get you altitude. However, if you have neither, and a nearby enemy aircraft *does* have either, you're at a severe disadvantage.

Fortunately, there are a couple of things you can do to avoid or lessen the effects of that situation. When climbing (storing E), make sure you retain enough airspeed to make good use of the vertical plane. This way you won't get caught with your pants

down and only have the option to turn toward the earth or in the horizontal plane. Needless to say, if you lack airspeed and try some vertical maneuver, you'll be left hanging on the high side, and the enemy will most likely follow you and nail you at the top because you've become too slow. Of course, if you have no speed (as in barely enough to remain flying), you can turn nose low to use gravity to assist in the turn. You can accelerate very quickly with the assistance of gravity, but remember that after any potential E trade, you almost always end up with a net loss. The key is to maximize your total E capacity.

GRAVITY: IT'S THE LAW

Okay, gravity will help you increase your speed in a dive, but conversely, it works against you in a climb. Your relationship with gravity remains the same during vertical maneuvers because in order to move on the vertical plane, you need to be either climbing or diving. Therefore gravity can help you part of the time, but it can hinder you at others. However, just as with anything else, if you understand it, you can take advantage of it—or at the very least, minimize the unwanted effects caused by it.

A good example of this concept is a straight-loop maneuver. While you'll most likely never do a full loop in combat (maybe except to illustrate what *not* to do), it's a simple, easy to understand maneuver that illustrates the benefits and consequences of gravity quite well. Furthermore, if you break up a loop into smaller components or steps and analyze them, you'll recognize that it consists of portions of other maneuvers that are used frequently in air combat. Both the Split-S and the Immelman (which has been reported to not have actually been invented by Immelman) are examples of this. They are both made up of half loop with a half roll added before and after the loop portion, respectively.

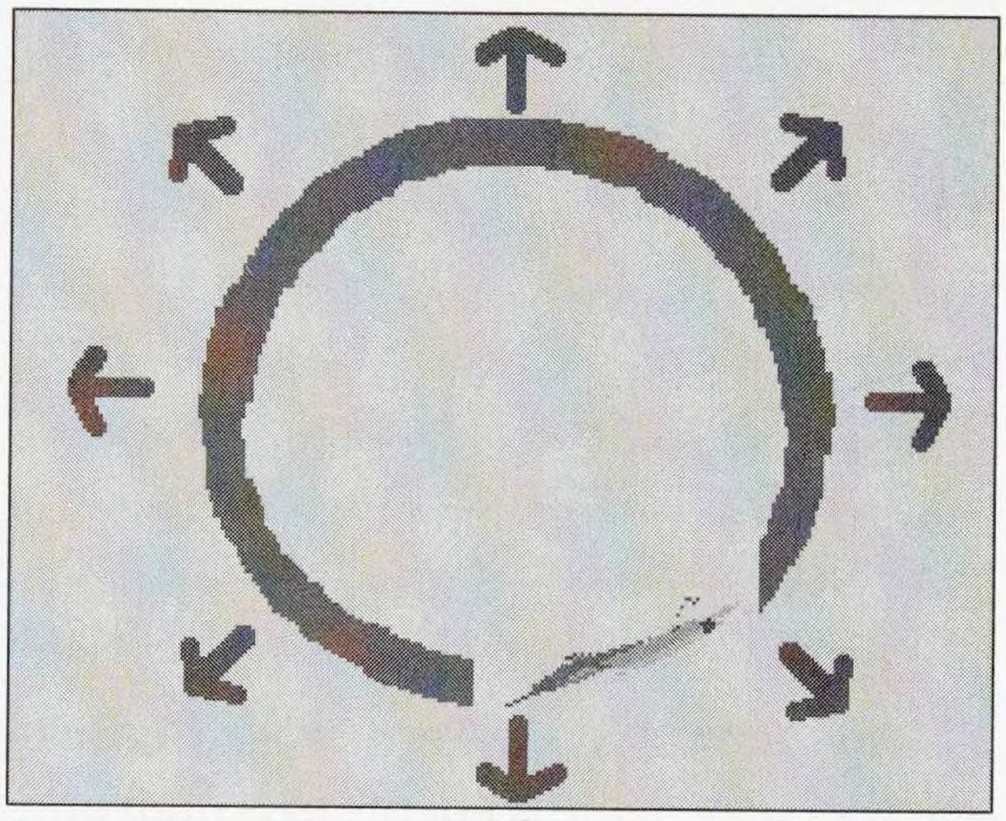
NEWTON'S LAWS—FRIEND OR FOE

Unless you're flying aerobatics and go out of your way to fly a perfectly symmetrical loop (like a perfect circle), a loop usually looks like a hastily written, script lowercased e. That is, the entry starts gently, goes vertical, curves sharply at the top, then the exit curves gently and ends up at a lower altitude than at the start.

Breaking this down into sections, at the very start of the loop you must generally make a rather smooth pull up because most of the time you'll either exceed your aircraft's structural limitations or black out. Gravity and centrifugal force are working against you. You're trying to climb and gravity is pulling you down and bleeding off

your airspeed (you've just netted an E loss, too). Near the top of the loop, your aircraft has slowed down and now gravity pulls you back toward the earth. Slower airspeeds produce tighter turning radiuses and lower centrifugal force. In addition, gravity is pulling in the direction you want to go. This causes the top of the loop to *pinch*.

As you make your way toward the bottom of the loop, the exact opposite occurs. Your airspeed increases, which increases centrifugal force, and increases your turning radius. If that isn't bad enough, gravity is back to fighting you, so you have to deal with blackouts and structural failures once again. This causes your loop exit curve to relax (straighten). Most of the time you'll find that you're at a lower altitude than when you started because if you exit the loop back at your starting altitude, you'll have to decrease your airspeed on the way down and end up at a slower airspeed at the finish.



Regardless of whether you end up at the same altitude with a slower airspeed, or end up at a lower altitude with the same airspeed, the results are the same: a net loss of E from when you started. Whether you fully understand all of this or not, the concept to remember here is that when you're diving toward the earth, gravity helps you; when you're climbing away from the earth, gravity works against you.

STRATEGY ASPECTS

Basically, just as with any air combat maneuvering, there are only two reasons for going vertical: to turn and set up your kill shot or to escape one. If you just want to turn, why do you need to do it vertically? This question can be answered on two different levels: out of necessity or for the sake of efficiency.

Escape and Kill

The simplest, most basic reason to use the vertical plane is because your opponent immediately warrants it. If you're defensive and don't have a high enough energy and speed advantage over your attacker to get away, you'll need to maneuver so as to only allow your opponent the most difficult shots at you as you try and disengage. Granted,

you never should get yourself in this losing position in the first place, but nevertheless, since you're already there, you have to deal with it. Maneuvers on the oblique plane (which requires a vertical component) are the most difficult for which to achieve gun solutions. If your situations were switched, your opponent would try the same thing on you. This would require that you follow him. You'd have to go vertical as well to make the kill. That of course is assuming he's in range, you've been doing everything well, you've kept your energy level high enough, and you're in an aircraft able to allow it.

Efficiency

The other reason for going vertical is that sometimes it can be a more efficient way to turn. The deciding factor on which is best is dependent on pilot proficiency, flight modeling, specific aircraft performance, energy state, and your current strategic positioning in relation to your opponent. Let's assume you're outside of the bandit's weapons range and far enough away with enough energy to turn in any direction without the risk of immediately taking hits (remember we're talking about guns-only, prop fighters now).

Any turn, whether vertical or horizontal, will cost you energy. Many argue that one way may net less energy loss than others; however, there are no perfect solutions with a particular turn. The same variables—pilot proficiency, flight modeling, specific aircraft performance, energy state, and your current strategic positioning—affect your chances in all cases. Nevertheless, going vertical to turn, in the example here, does offer an advantage. As was mentioned previously, a high-rate level turn will bleed your airspeed. After the turn you end up with a loss of kinetic energy. Note that while turning level to the left or right nets the same results, when going vertical, due to gravity, going up or down yields very different results. This of course, affects your energy status and turn rate.

Up or Down

The two most common maneuvers to turn an airplane around going up or down are the Immelman and the Split-S. Besides where the half roll portion is performed, the main difference is that one is a climbing maneuver and the other a diving maneuver. Let's look at how they differ in efficiency.

The Split-S trades potential energy (altitude) for kinetic energy (see Figure 1.4). At the end of the *turn* maneuver, you still net a loss of energy , but technically speaking, what you've lost in altitude, you've gained back (somewhat) in speed. This is

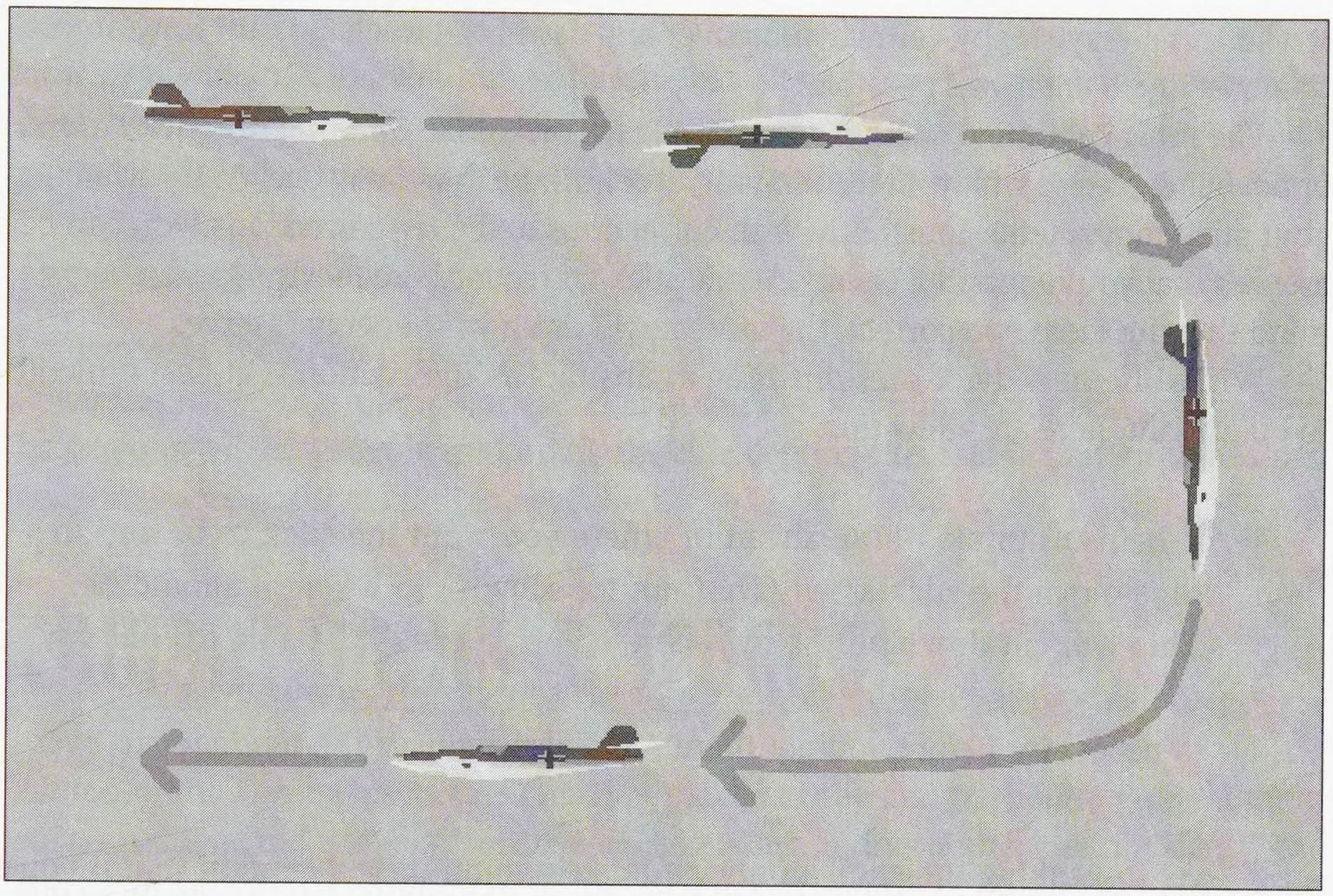


FIGURE 1.4: The Split-S trades potential energy (altitude) for kinetic energy.

markedly different from a level turn. However, potential energy is harder to come by than kinetic energy.

With an Immelman, you trade speed for altitude, and potential energy can be more valuable in the long run. This means that climbing vertical turns and maneuvers, such as the Immelman and half Cuban-8, do bear an advantage over the others. In addition, you can generally get turned around quicker using an Immelman rather than a Split-S (if you have enough energy to complete the Immelman). With the Immelman, gravity works while your airspeed is the slowest. With the Split-S, your airspeed is generally higher (you can throttle back, but it costs you energy even though your potential energy loss is less), and you know that higher airspeeds produce a wider turning radius.

Retaining Energy

Of course, the above examples are only valid if the pilot performs either maneuver with equal levels of skill. It is quite easy for a pilot to *hose* away his energy, regardless of the direction of the maneuver. A well-executed level turn can easily outperform (in

efficiency) a very sloppy vertical maneuver any day of the week. So, just how do you retain as much energy as possible?

The most common "energy waster" is a lack of finesse. Yanking the stick around or not being precise with your movements all contribute to wasting energy. If you adjust your stick movements constantly with corrections and over-corrections, you can be assured that you're wasting energy. While stick corrections are inevitable, just bear in mind that the more you correct, the more it will drain your energy reserves.

While offering advice on something as abstract as stick action is at best difficult to do in print, here are a few tips:

- It helps to think a little ahead of where you want the stick to be and to thus move the stick slowly (but not too slowly) to where it should be. This will cut down on the over-corrections, as you'll be able to *feel* how the aircraft is handling and get a better sense for how much movement is necessary before you get there. This also reduces the tendency to over-shoot your goal.
- As to yanking the stick around, it is a common misconception that if you use more stick than you actually need, you can get to the desired aircraft position faster than if you didn't. While your control surface movement is faster, regardless of the over-correction problem mentioned, if you move the controls faster than the airflow over these surfaces can accept, you'll cause local disturbances and actually decrease the rate of desired aircraft reaction. This is in addition to the extra drag (with loss of kinetic energy) such conditions contribute to.
- While excess control inputs affect both ailerons and elevators, aileron movement creates much less drag than elevator movements. Recall that excess elevator input leads to stalls and accelerated stalls. Both are to be avoided at all costs. As you know, stalls rob you of energy.

He Who Hesitates Can Win

When tailing a bandit moving in the vertical plane, it is useful in some cases to *hesitate* a bit before following him up. Well, hesitate is probably the wrong word to use. Follow him, but at a slower rate. The idea is to expend your energy at a lower rate than

your opponent. This gives you the opportunity to nail him up at the top if he gets too slow or the chance to meet him with a higher airspeed on his way back down if he goes that way. By not following him up and over immediately, you can see what he's going to do, and you will have energy to do something about it.

The Lift Vector

Lift is considered to act perpendicular to the wings. This is referred to as the *lift vector*. Regardless of your airplane's orientation in the sky, your lift vector acts perpendicular to your wings. What is important about accepting this fact is that airplanes can generate more positive lift than negative lift.

AIR COMBAT BASICS: DISENGAGE

Although the Disengage stage is usually placed at the end of the list of air combat stages, understand that just because it's listed last, it doesn't necessarily signify the end of an air combat confrontation. While you can choose to disengage to end combat at that time, you can also choose to disengage for other combat-related reasons.

Without considering mission objectives, there are only four ways to resolve an air battle: you shoot your opponents down (and you're left flying), you go down in flames (and your opponent is left flying), you both go down (usually the result of a mid-air collision), or neither of you get shot down and you both go along your merry way. In terms of desirability and difficulty, obviously shooting down your opponent is most desirable; however, while it is usually relatively difficult, it isn't always the *most* difficult, as you'll soon see. On the other hand, getting yourself shot down is definitely the easiest, but it's also the most undesirable (at least for your side).

Mid-airs gain you a *kill* of sorts, but you're no longer flying and likely failed your mission, so for all intents and purposes, your *game is over*. This leaves getting away while your opponent is still able to fly. Sometimes this is mutually agreeable, and sometimes it isn't. It's when your opponent isn't cooperating (why should he?) that you'll find disengaging the most difficult, not to mention dangerous. However, there are some basic concepts that can help increase your chances.

WHAT IT IS

In air combat terms, to Disengage means to put as much space between you and your opponent as you can, so you're outside of weapons range. While this would suggest that at some point before this you've been *within* weapons range, some strategists don't list that as a prerequisite. Some argue that you can't disengage unless you've already been engaged. If you avoid a battle by maintaining your distance from your enemy by never engaging (or in other words by remaining disengaged) you never enter air combat, since it takes two to tango.

While the issue is really all about semantics here, if you enter the Detection stage of air combat, you can skip to Disengage stage even though you've never entered within weapons range (Attack Stage). By entering the Detection Stage, you're clearly within the air combat stages, so everything else can be analyzed as such.

RUN AWAY!

No matter how you classify it, let's assume you've already entered weapons range and now wish to leave for whatever reason, and your opponent is still flying (after all, if he isn't, the battle is over). On what criteria you use to base your decision to disengage can be anything from tending to your mission objectives (such as assisting when your bomber group is under attack) all the way to being damaged or out of ammo. Bummer!

The Need for Speed

The most basic way to disengage the enemy is to just fly away from him or her. If your airplane is much faster or you possess a great deal more E (energy) than your enemy, this can be accomplished easily. In World War II, the use of superior speed was the basis of the successful *hit and run* tactics used by the Allies. If you're not familiar with this, basically you make a high-speed head-on pass with the enemy and continue flying away before he can turn and shoot at you (in other words, you disengage). When at a safe distance, you'd turn around and do the same thing again, and again, until the enemy was no longer flying.

This Way and That Way

If your aircraft does not possess a distinctive speed advantage or you do not possess a large E advantage over your enemy, it makes disengaging much more difficult. Pilots refer to what happens next affectionately as *turning and burning*—dogfighting. This is where your fancy flying either pays off or gets you killed. If you've got a bandit on your tail, the best chance you'll ever have to get away from him is when the nose of his airplane is 180 degrees off of where your nose is pointed.

However, to get to this highly desirable position usually means you've had to bleed off some E in the turning that got you there in the first place. Therefore, your ability to speed away safely is greatly reduced. Herein lies the dilemma. If you keep your E high by making gentle turns, you'll most likely get your tail shot off. On the other hand, if you're pulling big-time Gs, when you achieve the coveted 180-degree T2T position, you're too slow to get away before the bandit turns and gets you in his gun sights again.

Unfortunately, there isn't any magic maneuver that will get you out of all situations every time. Do something unexpected and you'll increase your chances. Beware: *unexpected* doesn't mean something suicidal, like a tail slide! Ultimately, you want to do something that'll put you in that magic 180-degree T2T position with lots of E to spare and leaves your enemy E bank overdrawn.

Also try flying where your pursuer will lose sight of you. This means flying below his nose and under his airplane. If he loses sight of you and becomes disoriented, you'll increase your chances of getting away.

Spin to Win

Intentionally going into a spin sounds stupid, but it sometimes works against AI opponents and real opponents. The drawback is that if it doesn't, you'll end up at a lower altitude with very little E. Make sure you know how to get out of a spin again.

Take the Low Road

This tactic that should only be used in final acts of desperation. If you ever find yourself out of ammo, airspeed, and ideas, bring the battle to ground level. Many times the enemy won't follow you down. If he doesn't, you can get away. If your pursuer does follow you down on the deck, you can hope that he isn't a very good pilot. Less skillful pilots will auger into the ground because they're concentrating on shooting you down rather than watching their altitude. Just fly around, decreasing your altitude a

little at a time. Before you know it (or rather, your opponent knows it) he or she will be too low and a ball of fire on the tarmac.

Of course, sometimes you can help opponents toward their demise. One trick is to do a Split-S very close to the ground. Pull your throttle all the way back and drop your flaps on the way down. This will allow you to decrease your airspeed so you can squeeze the bottom of the loop and so you won't hit the ground. If your pursuer is too pre-occupied with following you, by the time he or she catches on, he or she will be flying too fast and will fly into the ground. It really works. Just learn what the minimum altitude is that you can pull it off at before you battle test it.

THE REALITIES OF DISENGAGE

The brutal realities are that even equipped with the best training, strategies, and information, disengaging the enemy may not be possible without some *assistance* from your opponent. In other words, your opponent usually either has to screw up or want to let you go. It's really that simple. Of course, the fancy flying you use to dazzle him is intended to get him to screw up. However, if you're flying an inferior aircraft that is damaged, it will decrease your chances of making it home, let alone completing your mission. Aren't you glad you're only flying a sim?

?

AH-64D Longbow

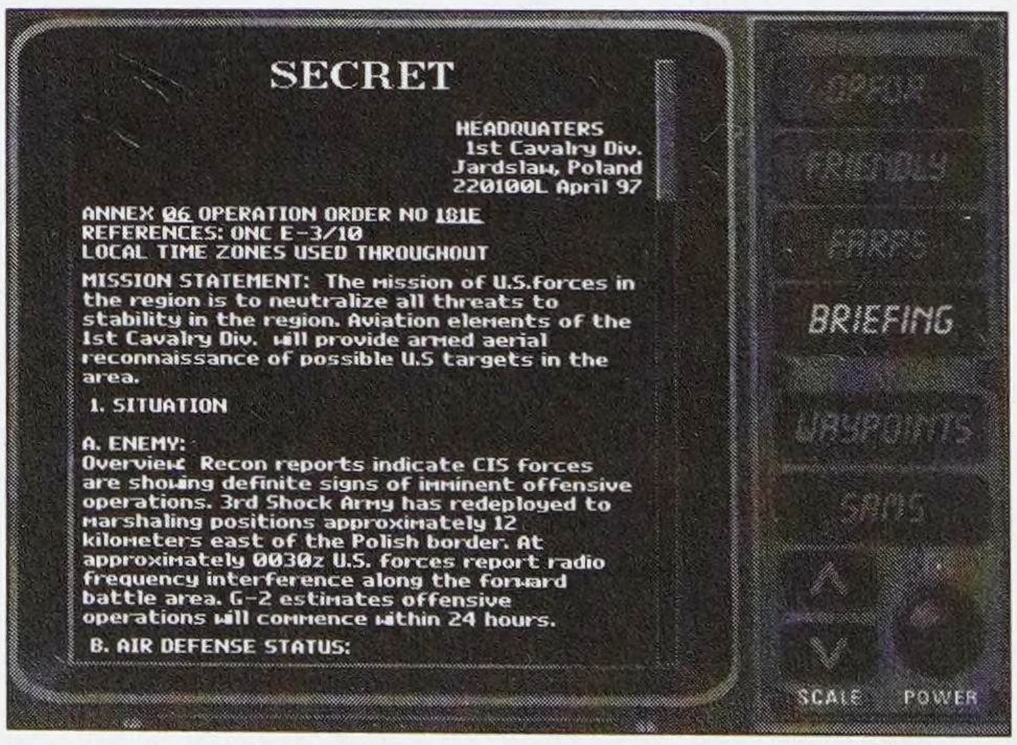
Jane's *AH-64D Longbow* has quickly made its way into the realm of flight sim classics in a lot of people's books, but if the missions also give it a spot on your top ten most notorious list, here are some tips to help ease your struggles. With a little insight and a lot of practice you'll be a success in no time.

GETTING THROUGH MISSIONS

While the excellent tutorials in *Longbow* give you all the information required to fly the AH-64D successfully, the instructor will only get you so far with regards to completing missions (see Figure 2.1). In order to be really successful at *Longbow*, you need a little more information, which is what this chapter is all about.

THE BRIEFING

Of course, reading the mission briefing is very important. However, there is a lot of stuff presented on the briefing screen that, while interesting to some extent, isn't necessary to know to complete your mission. This leads to skimming over the



CD-ROM

Check out the CD-ROM included in this book for a video of Jane's *Combat Simulations*.

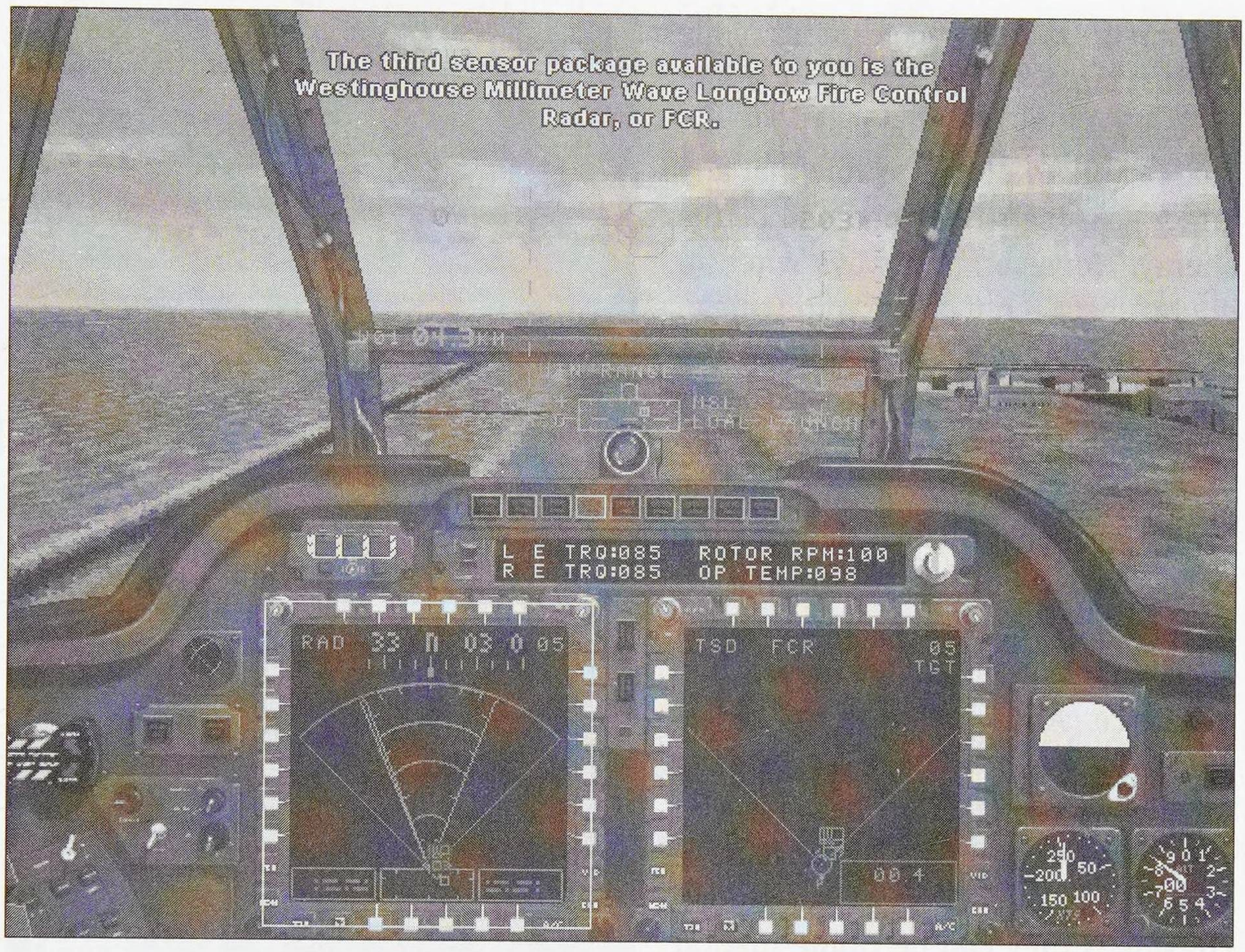


FIGURE 2.1: Tutorial information can help you learn to fly the AH-64D.

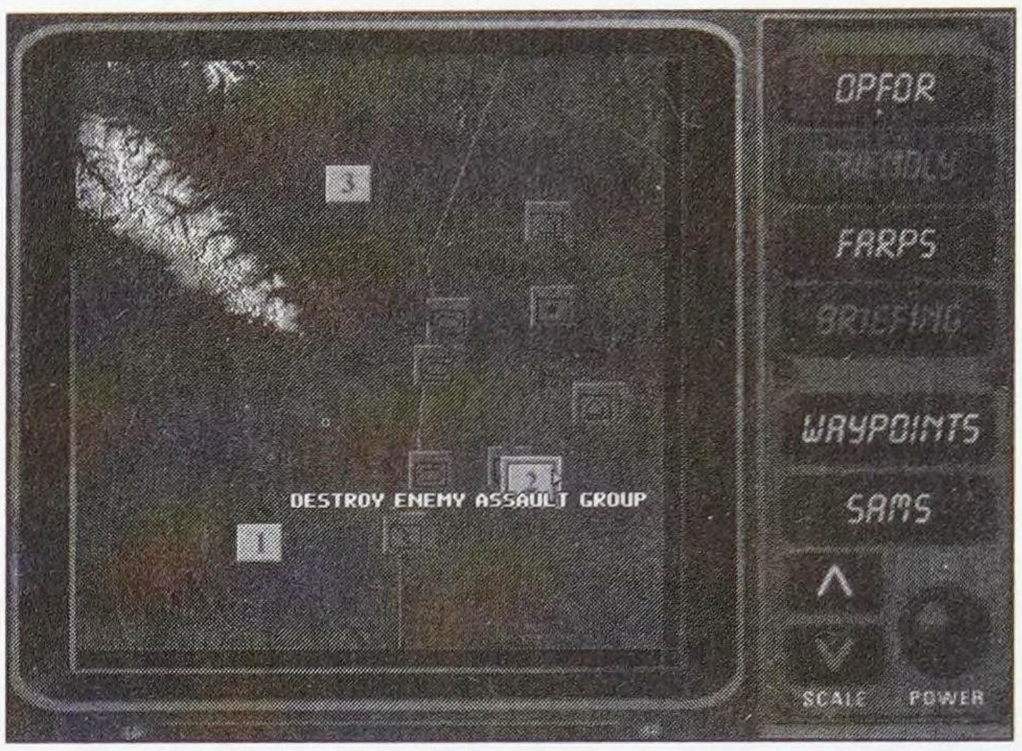
material rather than reading it. But sometimes not reading every word can get you into trouble. What you need to know is *what*, *who*, and *where*.

First, note *what* your mission is. If you're only to fly recon, knowing this beforehand will usually stop you from destroying things and failing the mission as a result. Second, know *who* the players are. Know who you're escorting or who you have to ID or destroy. Finally, use the map to go over *where* the battle line is and where the mission is to take place. After all, the likelihood of successfully completing a mission by attacking the wrong tank column is slim to none.

PLANNING

Essential waypoints can't be altered in *Longbow*, but you can add some of your own. This can be helpful if you have less than perfect directional orientation while in flight or need other visual cues for important positions. At this stage note which waypoints

contain the last known positions of the mission targets. This can be very useful for determining who the bad guys are. You can pretty much assume that any target near the strike zone will be the enemy. However, as always when in doubt, check it out or use your wingie.



While the weapons you'll use and the chopper you'll fly aren't located on the mission planning screens, they both are very much a part of mission planning.

Which weapons you take along really depends on your targets. If you have many soft targets, rockets can serve you well because they can get the job done, and you can carry lots of them. If you have hard targets such as tanks, Hellfires are the weapon of choice. Always choose the radar-guided AGM-114Ks. There is no penalty for always using these because you can't run out of them. The advantage they have over their laser-guided cousins is they can be ripple-fired at multiple targets. Lasers can only be locked on one at a time.

You always have the choice to fly the AH-64A or AH-64D in every mission. Choose the "D" unless you're interested in historical accuracy in the historic missions. The manual in *Longbow* goes into the exact differences between the two, but generally the "D" (Longbow) has the venerable Fire Control Radar (FCR), more digital displays, and is basically much more capable than the "A" model.

FLYING TIPS

If you're either a rank chopper novice or a veteran who fully understands and executes missions according to doctrine, your greatest enemy will be the ground. If you're a

novice, you're very likely to crash into the ground before reaching your targets. On the other hand, if you're a knowledgeable vet and fly your missions properly, the enemy won't get a shot off at you. At this level, the ground again becomes your most potent foe. Other than plenty of practice flying, the only other beneficial tip here is *fly slow*. This may go against what you want to do—fly low and *very fast*—but besides being very difficult to do, that isn't the way the real guys do it. Nap Of the Earth (NOE) flying at very low altitudes is just about impossible at full tilt. Also, if you fly too fast, you limit your reaction time if you suddenly happen to fly over a well-hidden AAA unit.

THE ART OF NOT BEING SEEN

While the AH-64 isn't considered a *stealth* aircraft, your greatest asset is the ability to get in, do your thing, and get out without being detected, if flown properly. If the best defense is a good offense, the best offense with the AH-64 is not being seen. By avoiding detection, you can avoid all threats. After all, if the enemy can't see you, they can't shoot at you.

The way to accomplish this is to fly low—very low. Flying below 70′ during your ingress is usually fine, but flying under 40′ AGL will allow you to go virtually undetected in most situations (flying 40′ AGL on the top of a mountain won't do much for you). Of course, this is easier said than done. As was just discussed, NOE flying below 40′ AGL requires that you fly slowly (depending on the terrain, 90 IAS or slower is comfortable for most—go even slower at night).

Another thing you can do to increase your chances of not becoming a lawnmower before reaching your objectives includes not flying down into the bottoms of every valley when flying NOE. As long as you're below the mountain tops located between you and the enemy, you're safe. You also do not need to fly your exact flight path depicted by your waypoints. If your flight path leads you over the top of a mountain, go around instead. Just re-establish your original flight path on the other side. It may take longer to reach your objective, but your chances of getting there alive increase dramatically.

FINDING AND SELECTING VICTIMS

Okay, the heading for this section should read "Targets" instead of "Victims," but the AH-64D is such a lethal weapon that it almost seems unfair (no complaints here) to the enemy. Your targets are almost literally *sitting ducks*! Anyway, with such a capable killing machine at your disposal, it's often very tempting to shoot every enemy you

run across. While this can gain you points, if you don't take out your assigned targets, you'll fail your mission. Furthermore, if you *waste* ammo on non-mission objective targets, you risk ending up short when you do reach your objective.

Deciphering *friendlies* from the enemy is easy since your Co-Pilot/Gunner (CP/G) does this for you (use the T key for enemy targets and the Y key for friendlies). Now that you know who the enemy is, you have to choose who to shoot at first. The saying "so many targets, so little time" applies.

Longbow presents a target-rich environment—much more than you can kill with any weapons load—so you have to select targets based on immediate priorities: threats, mission targets, and tanks followed by others. Threats of course include enemy aircraft, Anti-Aircraft Artillery (AAA), and Surface-to-Air Missiles (SAMs) as well as radar installations. If you take out radar, the enemy will be blind, and if they can't see you, they can't shoot you. Noticed that AAA was mentioned before SAMs. This is because

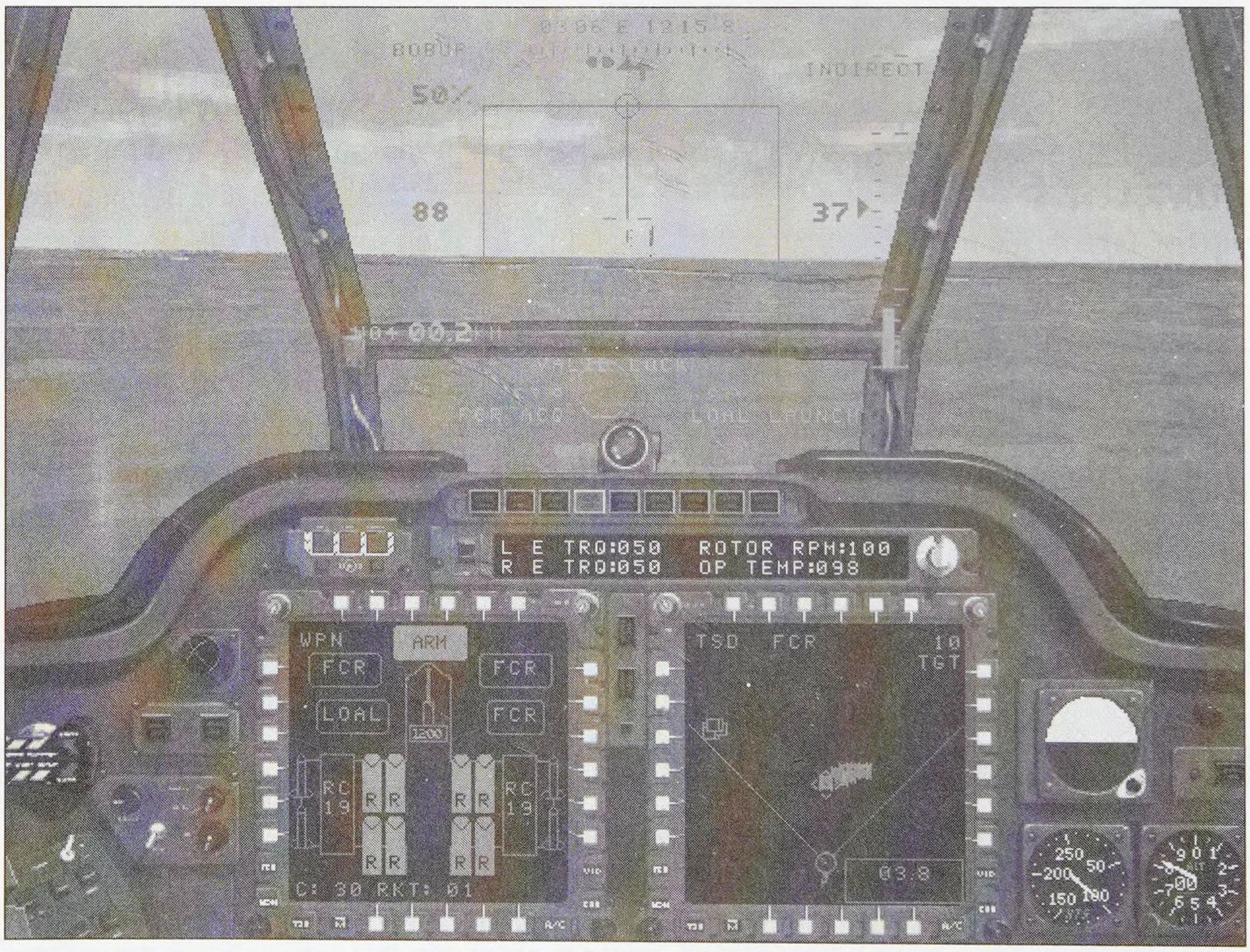


FIGURE 2.2: Deciphering targets is easy enough; deciding which to fire at first can be difficult.

if you fly low enough, SAMs won't be able to lock onto you, but AAA will still be able to get you.

Figuring out which targets are AAA and which are tanks can be difficult using Target Acquisition and Designation Sight (TADS) at long distances and dangerous if you need to close in to visually ID every target. If you have trouble ID'ing targets using the standard methods and don't want to *cheat* by pressing U and toggling the Upfront Display, you need to learn the symbolism represented on the Tactical Situation Display (TSD) and Fire Control Radar (FCR). There are no other shortcuts.

If you have trouble locating ground-based threats (and why wouldn't you since the enemy doesn't want to be seen either) come to a hover in a safe spot, add collective, and climb straight up. If there are any SAMs, AAA, or radar sites nearby, they'll light up your Aircraft Survivability Equipment (ASE) when you climb high enough. Note where the installations are, quickly reduce collective, and drop back down into your safe spot before they start shooting at you. Now go out and get 'em!

TAKING SIGHT OF THE ENEMY

As you climb Longbow's steep learning curve, these are some of the typical questions that might run through your mind: "Why can't I target that Shilka 1km in front of me?" "Am I supposed to sit here in plain view while my Hellfire lollygags its way to the target?" And the time-honored favorite: "Who's shooting at me? Where is *that* coming from?"

The key to avoiding these kinds of situations is an appreciation of the Longbow's two means of acquiring a target: the TADS and the FCR. Once you comprehend their respective nuances, the "Huh?" factor in *Longbow* declines rapidly.

TARGETING BY MAN OR MACHINE? TADS VERSUS FCR

The TADS is simply a suite of cameras mounted in the Longbow's nose turret, immediately above the chain gun. If you pan around to the front of the aircraft from the external view, you can see the turret rotate as you switch targets. Since cameras depend on light (or heat, in the case of the infrared camera), they're limited to line-of-sight. The important thing to remember about the TADS is that you don't control it; it's in the hands of your CP/G, the computer-controlled fellow sitting in front of you.

The FCR, on the other hand, is an advanced millimeter-wave radar system housed in the bulb above the rotors. Because it's clear of the Longbow's fuselage, it has an unobstructed 360-degree view, which it uses to scan for air targets. However, it can acquire ground targets from only within a 90-degree arc to the front (narrower than the 220-degree field of regard on the TADS, which has the advantage of being able to pivot on its turret). Unlike the TADS, the pilot has complete control over the FCR, and can pick out targets at his leisure. The FCR is also sophisticated enough to keep track of a target, even after it's no longer visible.

The FCR is the only place from which Priority Fire Zones (PFZs) can be used to limit rippled fire to specific targets. Although you can set up PFZs while you're using TADS, make sure to switch over to the FCR before you fire, if you want to take advantage of them. When using the FCR, anything you can see on the Tactical Situation Display is selectable as a target, with the added convenience of being able to use the mouse to pick targets. As long as you haven't switched to air-to-air mode, everything you've spotted so far is recorded. This will make it easier to avoid pockets of AAA or SAMs when retracing your steps.

You can also designate targets for air or artillery strikes all the way across the map. This is a good way to tack a few extra points onto your score if you're returning to base with leftover strikes—just choose a distant victim and let someone else deliver the weapons for a change.

The idea behind the TADS is that your CP/G keeps track of the immediately visible targets. Although you can still cycle though them using the T key, there's no quick and easy way to pick out something specific. The Ctrl+T command can be helpful if you're cycling to a specific nearby target. But the Alt+T command, which is supposed to single out the *best* target, functions according to some inscrutable logic. Remember that even though targets detected by the FCR will still be visible on the Tactical Situation Display while you're using the TADS, you'll be unable to select them (see Figure 2.3). This mode's strength is also its weakness: It takes the task of targeting out of your hands. However, it can be particularly helpful in hilly terrain, where enemies are liable to appear quickly, at close range, and at offset angles inaccessible to the FCR.

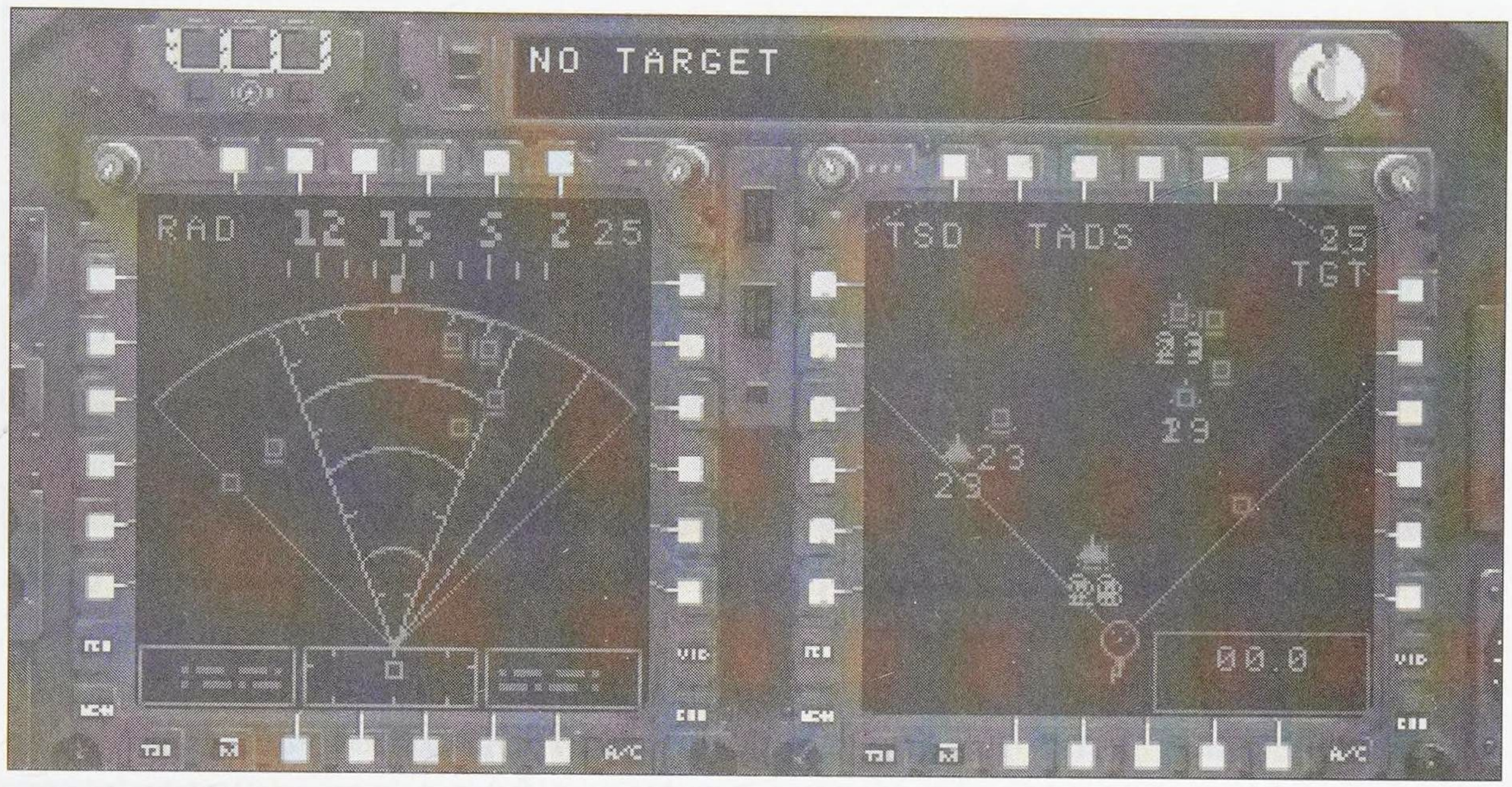


FIGURE 2.3: Although this FCR shows numerous target returns, the TADS is unable to acquire any of them because they're not currently visible.

Because of the very significant differences between the two targeting systems, the Home key, which toggles the TADS and FCR, is the most important determining element in how you see and acquire your targets. Always be aware of which mode is active. A great deal of confusion in *Longbow* results from trying to do something in one mode that will only work in the other mode, such as using the mouse to designate a target (FCR only), using PFZs (FCR only), or panning the helmet view (TADS only).

MORE FUN WITH ACRONYMS: TSD AND ASE

Another source of confusion is the interaction of your targeting systems with two important displays: the previously mentioned Tactical Situation Display (TSD) and the Aircraft Survivability Equipment (ASE). The TSD is where most targeting and firing is done. If you're using the TADS, keep in mind that the CP/G can lock you onto targets spanning your forward 220 degrees, which covers quite a bit of territory to either side of you, outside the 90-degree area represented on the TSD (see Figure 2.4). This is particularly likely to happen if the CP/G gets fixated on something while you're turning.

You can find yourself cycling through off-screen targets without the targeting diamond appearing on the TSD. In these cases, note the Field of Regard box on bottom center of the HUD. It covers a 220-degree arc, and the centerline gives you a clear indication of the current target's bearing.

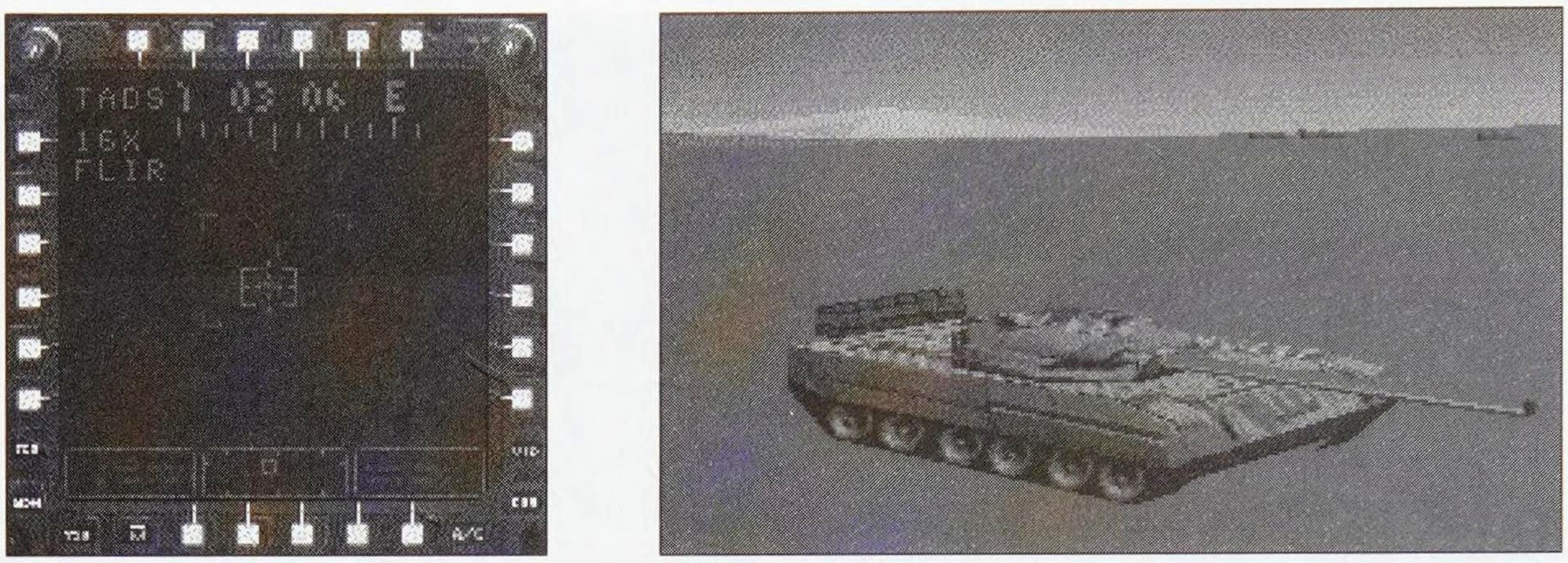


FIGURE 2.4: What sort of bionic eyesight does the CP/G have to identify this speck (left) as this T-72 (right)?

Note that other aircraft will always appear on the TSD, whether you've chosen the air-to-air or air-to-ground mode. Air-to-air mode is useful in the event that an enemy helicopter manages to get behind you—the only way to keep track of its position is with the 360-degree air mode on the Radar Display. Otherwise, this mode only serves to filter out all ground targets, with the unfortunate side effect of erasing everything in the FCR's stored target list.

The ASE keeps track of all active anti-air threats on the ground and draws no information from either the TADS or the FCR. Enemy aircraft will not appear. Neither will units that have switched off their search radar, as most AAA units will do until you're on top of them. And unlike the FCR, your ASE will not store the threats it has previously detected. It's strictly a passive sensor and it only gives you the current situation (your jammers and chaff dispenser are integrated into the ASE, but they play no part in the display). Unless you're trying to skirt around a long range SAM's detection radius, it's not important to have the ASE on one of the displays; it'll automatically pop up whenever a new threat appears or an old one begins to track you.

HOW I LEARNED TO LOVE THE U KEY

Target identification is a problem in *Longbow*. The displays are too small, and the zoom levels don't go high enough to make out any tell-tale detail on distant objects. Furthermore, the tiny screens don't allow for enough separation between distant targets clustered together. From 5km you're just as likely to launch a Hellfire at an innocuous fuel truck as you are a ZSU-23. In a real Longbow, the displays are larger than 2 inches

across and the DTV zooms in to a 128× magnification. But in Jane's *Longbow*, you have the U key.

Now set your minds at ease: The U key is not necessarily a *cheat*. Try and feel more comfortable using it. One could argue that if the U key is a cheat, then so too could you classify the T and Y keys as cheats. Real-world battlefields offer no such immediate and accessible distinction between enemy and friendly units. If you're determined to simulate reality by not using the U key, then you probably have to randomly and blindly hit either the T or the Y key when you want to cycle targets.

LOOK, MA, NO HANDS!

The Instant Action offers a prime opportunity to practice targeting skills. By putting the Longbow on autopilot, you'll embark on a long route through terrain choked with enemy units. The default setup is for invulnerability and unlimited weapons, so you won't have to worry about evading incoming fire and conserving your weapons. This makes for an excellent practice arena in which you can see first-hand the important differences between the FCR and TADS.

You'll also be able to tinker with PFZs and test ripple firing, while watching closely how the ASE works. It's especially instructive to see how the different enemy threats behave: when they go active, the distance they can fire, and the altitude at which they can track you. Even if you're an old pro at this, it can be illuminating to take a break from the flying and concentrate solely on the weapons systems for a change. After all, you never know what it's like to be a CP/G until you've flown a mile in his cockpit.

3

Apache: The Combat Helicopter Simulation

To the delight of combat chopper sim fans everywhere, Interactive Magic has released the sim with the most realistic helicopter flight model yet, *Apache: The Combat Helicopter Simulation*. While there is an arcade flight model option, just about everyone should fly the realistic model. The realistic flight model is *harder* to fly because it mimics a helicopter and all the quirks that real helicopter pilots and students have to deal with. If they can deal with it, there really isn't any reason why you can't also, if you're willing to devote some effort to doing so. Just take it like they do—a little at a time.

FLIGHT BASICS

The advantage of spending the time to learn to fly the realistic model is that it'll allow you the freedom to fly some of the more, shall we say *non-standard* sim maneuvers such as rolls, loops, and torque turns. The advantage of being able to perform these maneuvers (besides being really cool) won't be obvious until we start talking about the combat sections of *Apache*. For now, concentrate on getting up in the air and reducing the likelihood of the ground being your worst threat.

CD-ROM

Check out the CD-ROM included in this book for a demo version of *Apache: The Combat Helicopter Simulation*.

HOG AND BOG

It seems that with every new recent sim that is released, they all generally force the sim'er to make the same decision: "Do I run it with all the detail turned up so the flight section feels bad, or do I turn off some or all of the detail so the flight seems smooth?" Well, if you're into combat more than sightseeing, go with the smooth frame rate. Fortunately, *Apache*'s CPU hunger is by no means the worst out there. In fact, for a modern sim, *Apache* is pretty good in that respect. However, for those of you with slower 486s, you may be happy to hear that *Apache*'s CPU appetite isn't totally graphics based. So, you may have a solution or at least a choice of what you want to cut down on. Some of the *bog* on a slower machine can be attributed to sound generation. If you run these on the lower settings, you'll be able to increase the visual detail and maintain frame rate. (Your mileage may vary.)

EFFECTIVE COLLECTIVE

The collective is a combination engine throttle and rotor pitch control. As you increase the collective, you increase downward thrust from main rotor blades. Simple, right? Well, the realistic flight model complicates things a bit. In realistic mode, it is possible to over-torque the engine. While you can over-torque the engine up to 130 percent, you cannot do so for more than a couple of seconds.

HUDS UP!

As an Apache pilot, your virtual helmet is equipped with an Integrated Helmet And Display Sight System (IHADSS). It's just a fancy name for a helmet mounted HUD (Heads Up Display), as you can see in Figure 3.1. On the left side of the HUD, slightly above center, is the torque indicator. Note where it is because you'll be looking at it quite often.

In addition to the torque indicator, the communications data panel (the upper right-hand corner of the instrument panel) will give you another visual message when you've gone into an over-torque condition. If you're too busy looking at other things, *Apache* provides an audio over-torque beep warning. Anytime you go over 99-percent torque, the beeps will start and the visual message on the data communications panel will appear. Until you become more proficient at flying helicopters, if you keep the torque setting (via the collective) at or below 99 percent, you can usually leave it there and not have to worry about it, as long as you're not doing anything very demanding.

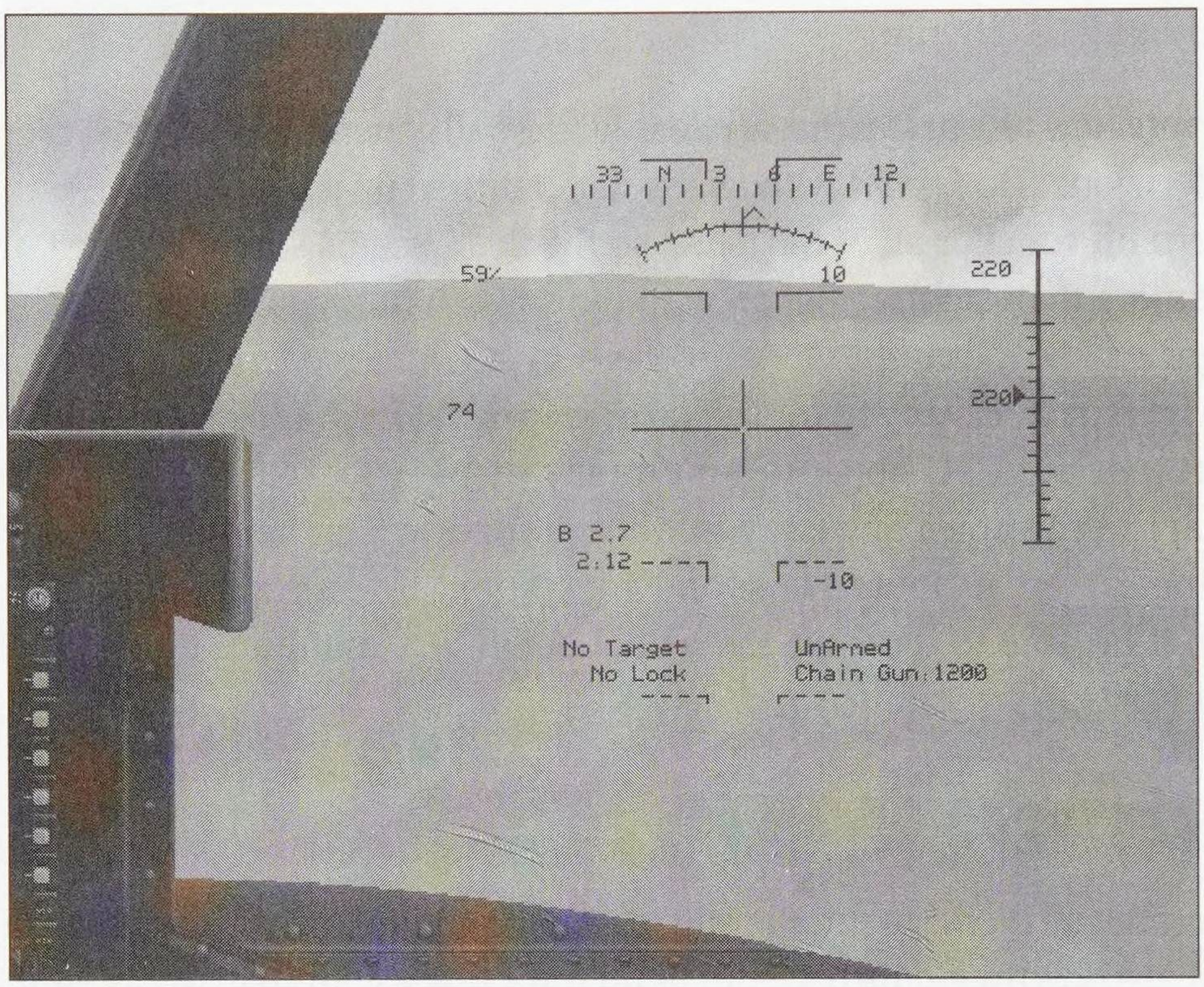


FIGURE 3.1: The Apache's IHADSS provides important flight information no matter which cockpit view you use.

HARDWARE HEAVEN

To play *Apache* consider getting a separate throttle joystick, such as the Thrustmaster TQS (Throttle Quadrant System) as opposed to using the keyboard for collective control. Set your TQS for analog running, as it makes the collective more responsive and accurate. The way to do this is to tell the TQS install program to install the stick as analog and then change the "USE WCS" line in the included .B50 file (on the CD-ROM) to "USE TQS." Next go to the Preference screen in *Apache*, select joystick for throttle, and calibrate it. In order to use all of the buttons on the TQS as the functions listed in that same .B50 file, you'll also need to rename the button identifiers listed from T1 to T3, T2 to T5, T3 to T4, T4 to T9, T5 to T10, and T6 to T2 or leave it as T6 to assign to the range knob switch.

HOW HIGH AM I

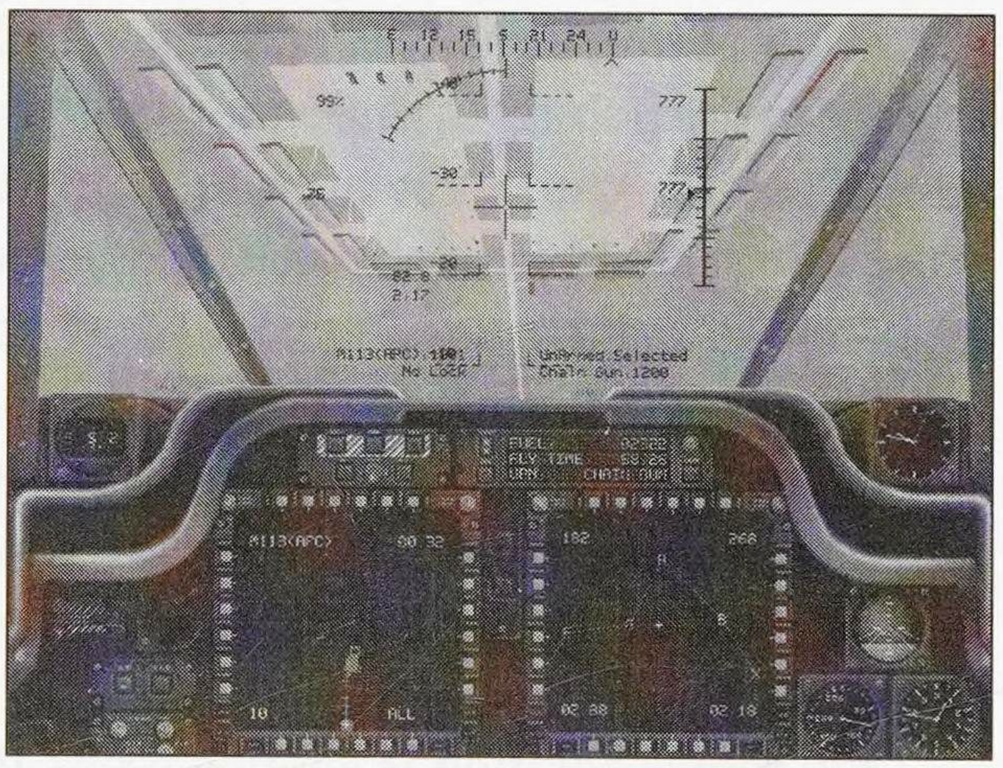
The next indicator you need to watch is the altimeter. *Apache* provides two. One is barometric and gives your true altitude above sea level (found on the upper right-hand

corner of the HUD), and the other is radar based (right, center of the HUD). This radar altimeter is more important to you as it tells you your exact height above the ground. It does you no good to know that your altitude is 3,000′ MSL when your height above the ground is 0.

When flying over a hill, the radar altimeter will indicate a downward trend. When you see this, you'll know that you'll need to fly higher as you get closer to the mountain. Watching these two altimeters on top of all of the other instruments you need to pay attention to can be overwhelming. Although the real Apache helicopter doesn't have one, *Apache*'s ground proximity alarm can help alert you.

FLYING APACHE

A helicopter can fly just about in any direction. For the sake of simplicity, let's just say there are basically two modes: hover and forward flight (backward flight is the same as forward, only reversed). Hovering is the harder of the two, although *Apache* has an auto hover key for you keyboard collective types. Each will be discussed in this chapter, but let's start with the easier of the two.



SURF'S UP, DUDE

Pushing forward on the cyclic moves the main rotors' thrust backward. This pushes you forward. However, with the realistic flight model, if you push forward too fast, you'll also lose altitude. The closest comparison you can make for these effects of forward and reeves flight in *Apache* is to surfing. The only difference is on one you ride on air, and the other you ride on water. Imagine you're surfing a mondo wave in your Apache and you'll see for yourself.

If you move the cyclic stick too far forward, you'll move forward at a quicker rate than the wave. Your forward velocity will increase, but you'll move down on the wave and lose altitude. If you pull the cyclic backward, you'll move rearward and also fall off the wave and lose altitude. Although surfers would love to have the capability to

do so, they can't compete with a helicopter. In a helicopter you can compensate by adding more collective and retain the same altitude as long as you don't try to go too fast too soon.

HOVERING

Hovering can be a little tricky because you're basically trying to balance on a column of air. Other than what is included herein, there aren't really any other hints to help you with this other than don't fixate on any one control or indicator. However, if you're using the keyboard for collective control and if you have problems finding the correct collective setting for hover, press N when flying less than 10KIA—you're collective will be set for hover automatically.

One of the most important indicators for achieving hover or level flight is the Vertical Speed Indicator (VSI). It is just a little arrow on the left side of the altitude scale. If it points above the halfway mark, you're climbing. If it is below, then you're descending. Keep the pointer in the center, and you'll be maintaining a constant altitude.

While you can get away with using the keyboard for collective control, the tail rotor is best controlled by a set of rudder pedals like the Rudder Control System (RCS, also from Thrustmaster). Keyboard rotor control is limiting. As you know, the tail rotor controls yaw. You press the pedal on the side that you wish the nose to turn toward. Some beginning pilots get confused when it comes to reeves flight. A good way to minimize the confusion is to always relate your position to the same location on the helicopter. Use the nose. No matter which way you're flying, you'll know right pedal moves the nose right.

Tail rotor operation is simple, right? Well, realistic flight mode again adds some spice. Tail rotor effectiveness is related to air speed. As your air speed increases, your tail rotor effectiveness decreases.

Fly fast and very low!

INSTRUMENT SCAN

Now let's discuss how to stay in the air and how to get back on the ground safely. This involves another important skill, called *instrument scan*. If you're a flight sim veteran, you've probably learned this skill already but may not be aware that you have. When you fly (airplanes or helicopters), you need to check all of the instrument discussed thus

far to know just how you're flying. Unfortunately, as your work load increases (such as when you're in battle) you won't have the luxury to glance at these indicators at your leisure. The instrument scan is a visual sighting pattern that you follow so you do not neglect looking at any indicator.

While there is no set pattern that is good for everyone, and you'll most likely have to develop your own, here's one example to illustrate the concept. When flying around and not in combat, try to limit your scan to a couple of core flight indicators on the IHADSS. (See Figure 3.2.) These are the radar altimeter, VSI, flight-pitch ladder, heading, airspeed, and torque indicators. Ignore all of the analog flight instruments and only revert to them if your IHADSS goes out.

Combat flying adds a second group of indicators to scan. A combat scan group basically revolves around the Multi-Function Displays (MFDs), target, and weapon status displays. (See Figure 3.3.) At the beginning of a mission, set your left MFD to ground/air radar mode with high target priority masking and the right MFD to Tactical Situation Display. When flying in combat, your scan should still be based on the core flight indicators, but you should include the elements of the combat scan. Finally, when you hear warnings (whether vocal or beeps), scan over to the Communications Data Panel. Don't forget to pay attention to this little jewel.

An instrument scan can be difficult to learn at first. When you scan an indicator, try to only look at it for a second and move on to the next indicator. Don't worry if you didn't fully comprehend what was displayed. Your scan should make its next stop back at that indicator in two or three seconds at most, and you'll get a chance to read it again. Just keep your eyes moving. The most common mistakes are to fixate on one

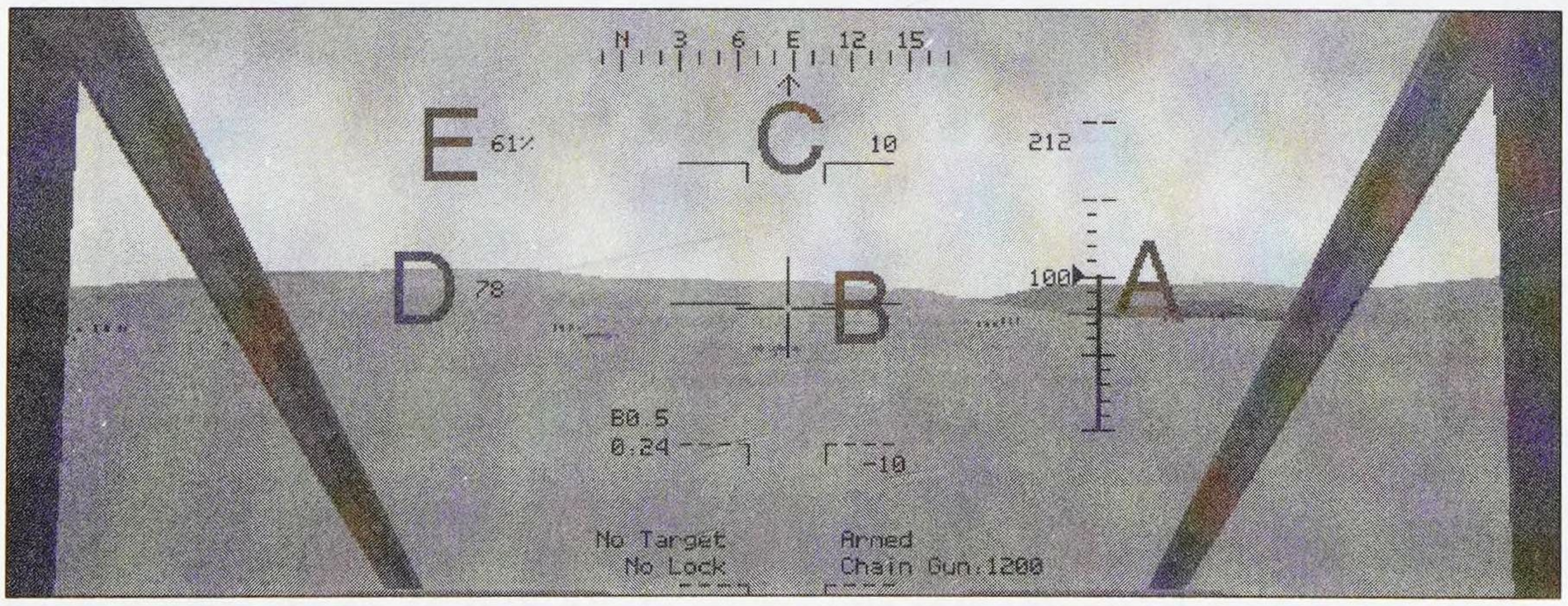


FIGURE 3.2: Your instrument scan pattern should include the core flight indicators: A) radar altimeter and VSI, B) flight-pitch ladder, C) heading indicator, D) airspeed indicator, and E) torque indicator.

indicator for too long and to neglect to scan important indicators. It may seem awkward, but keep at it and soon you won't even notice that you're doing it.

TWO SEATS AND ONLY TWO EYES

Since the Apache is a two seater, when you're playing in single mode, you have twice as many MFDs to look at. Some players may look at this as a disadvantage, but it really is an advantage. There are two such scenarios. Since MFDs are kind of awkward to cycle through in the heat of battle, what you can do is set up all four MFDs to whatever you like and switch between them by switching between the front and back seats. Any one of the four MFDs will then only be a click away.

The second scenario advantage is when one or more of your MFDs get damaged. If your front seat MFD is damaged, that doesn't necessarily mean that the MFD in the back seat is damaged too, and vice versa. Take advantage of it.

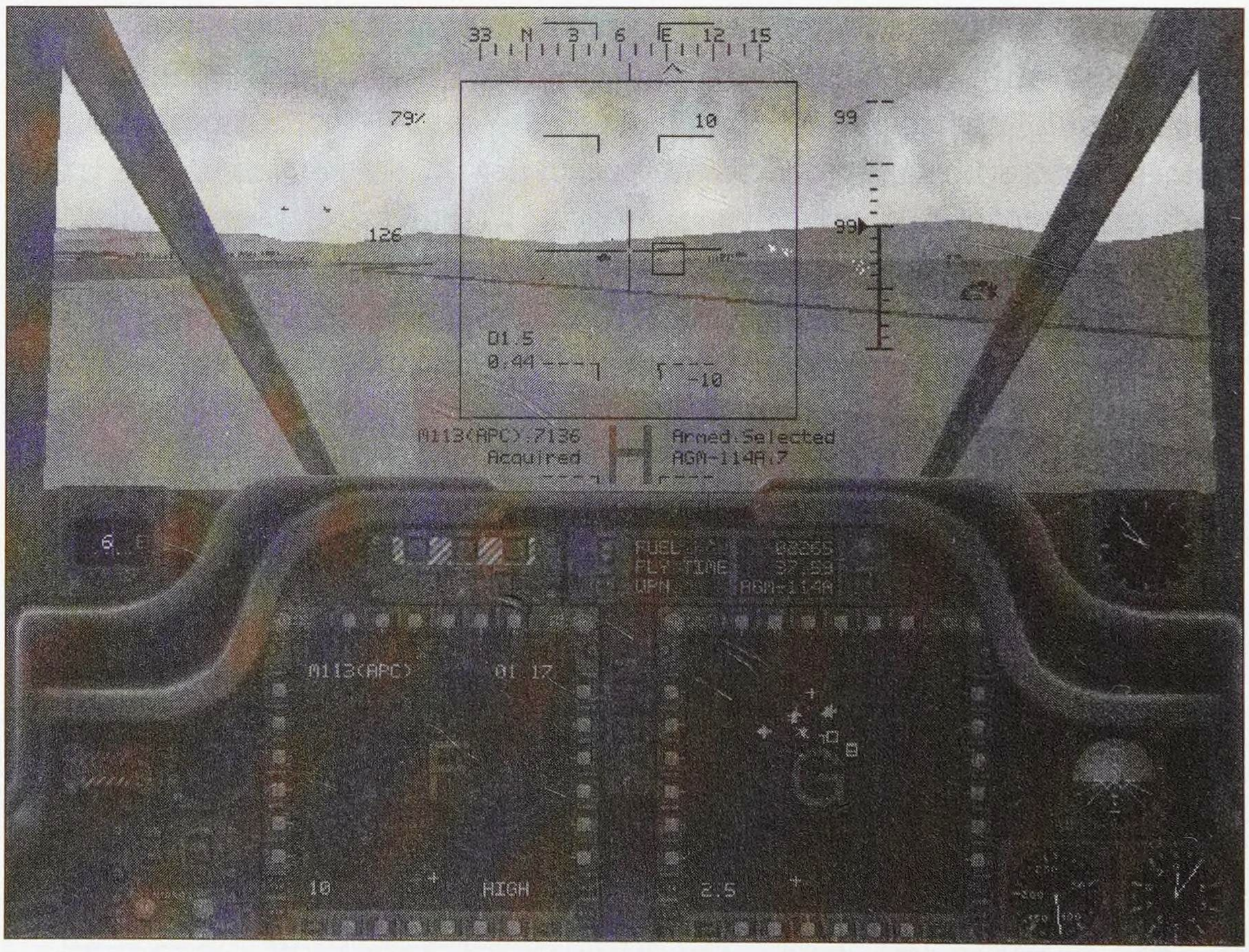


FIGURE 3.3: Your combat scan pattern should include F) ground/air radar, G) tactical situation display, H) target and weapon status display, and I) communications data panel in addition to your flight scan.

THREATS

The key to winning *Apache* is being able to stay alive. Shooting things is easy, but staying alive and returning home at the same time is the hard part. In *Apache*, threats can basically be categorized as ground based or air based. Let's start with ground threats first because they are more numerous.

Avoiding Ground Threats

Ground threats come in the form of SAMs and AAAs. Each is deadly, but they have their limitations. The most basic limitation is if they can't see you, they can't shoot at you. Because the Apache isn't stealthy, using ground terrain masking and distancing yourself from threats are your best bets. It's far better to avoid weapons fire in the first place than to try and outsmart missiles and AAA.

One tactic is to turn off your radar (Ctrl+R). According to Mike Chen from Interactive Magic, the Apache radar is active (emits a detectable signature that enemy AI can pick up on). By flying with it off, you can be that much *stealthier*—if there is such a word.

Terrain masking usually means flying between or behind hills, mountains, and buildings. If there aren't any nearby, your next best bet is to fly as low as possible. While there is no hard and fast number, generally, flying below 200′ will allow you to avoid some SAM threats. Of course the lower you fly, the better for SAM avoidance, but watch out! The ground and those exploding trees are as deadly as any SAM! Typically, flying at or below 100′ is comfortable, if you're proficient at flying (which includes a good instrument scan). Avoiding SAMs fired at you will be covered in a later air threat section dealing with missile avoidance because the techniques are basically the same.

The weakness of AAA is that it can't shoot very high, and it can't shoot very far. Since flying at high altitudes will attract SAM fire (which you don't want) and air threats, that leaves you with distance. The further you are from the AAA site, the less likely it'll fire at you. Unfortunately, since most of the targets that you're sent after are being protected by AAA, this can be a problem. So, unless the AAA is near your

mission targets or are your mission targets, just try and keep your distance from them and you should be all right.

However, if they do fire at you, you can best avoid damage by flying straight at them. This is because you can see their tracers. You have enough time to maneuver away from AAA fire, even at the highest enemy AI level, as long as you're not right next to them. The key is to try and destroy as many AAA vehicles as far away as possible.

LANDING

Landing is a very important skill to learn in *Apache*. While other sims allow you to end missions before actually landing, *Apache* requires you to land safely in order for any mission to be called a success. In addition to landing at airports, missions require you to land on ships also. Each is a little different. Also, when playing combat mode in network or serial play, the only way to repair and reload your helicopter is to land.

Landing is actually pretty easy. What most pilots usually have trouble with is the transition from forward (or whatever direction) flight to hover. This skill requires coordination and a good instrument scan. The transition from forward flight to hover usually results in a ballooning effect when the cyclic is pulled back to stop forward flight. To prevent this, decrease collective before pulling back on the cyclic. The amount of collective you need to reduce depends on how fast you want to slow down. If you're going pretty fast, don't be afraid to drop your collective to zero.

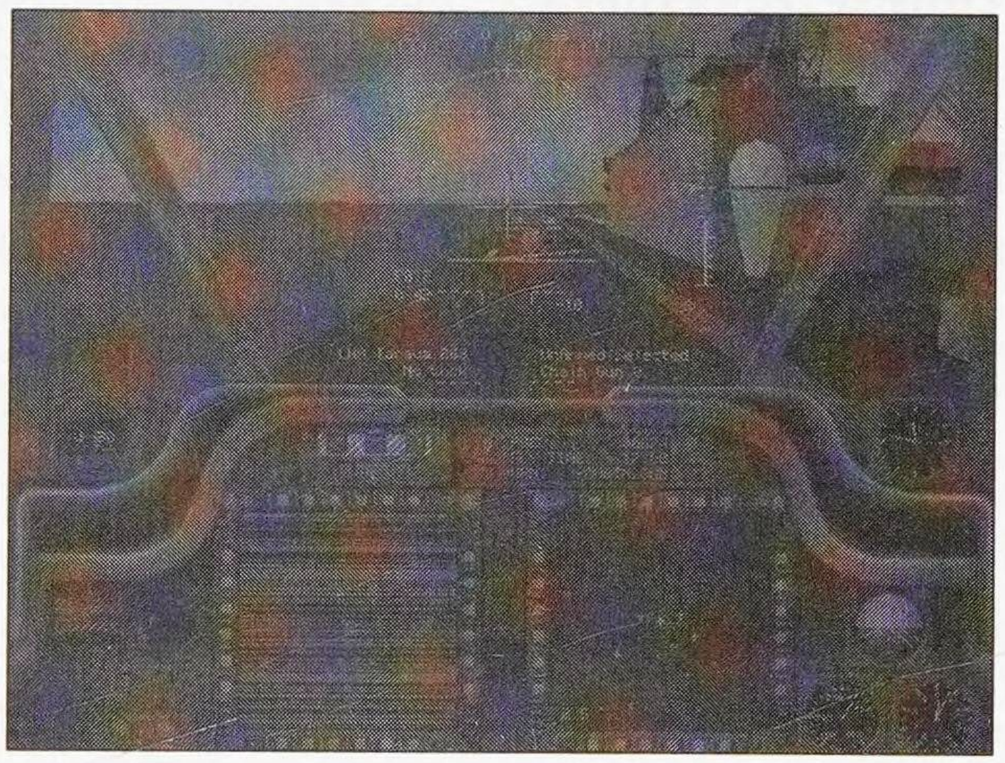
The amount of cyclic you'll need should be gauged based on the VSI. Pull back more if your VSI shows you're descending and push forward if you're climbing. Generally, the angle of attack that you'll end up at will be somewhere between 10–20 degrees above the horizon. As you begin to slow down (according to the air speed indicator) two things will happen. One is you'll need to lower the nose or you'll start moving backwards, and the other is you'll begin to descend regardless of your cyclic position. This means you'll now need to apply collective to reach hover or slow your descent. With some practice, you learn to time your cyclic push forward to level and meet 0 air speed at the same time.

In order to get those Airwolf-style landings, you'll want to only add enough collective to maintain a slow descent and bypass hover altogether. Gradually increase collective as you near the ground. The critical point you want to reach is a descent rate of less than 60 FPM (Feet Per Minute) somewhere below 50′ AGL (Above Ground Level). How can you tell what 60 FPM is? Look at your radar altimeter. Watch the numbers and count. If the numbers descend at the rate of one digit per second, you're roughly descending at 60 FPM.

INTERMEDIATE SKILLS

From a psychological standpoint, landing at the mock carrier test airfield with a crosswind is easier than landing on the deck of the Tarawa because you don't have to worry about crashing into one of the deck's superstructures or falling over the edge. In reality, even though the *obstacles* and crosswinds may not be the same, there really isn't any difference. Just as with any landing, the approach is key. Make a bad approach, and your landing will be more difficult (if not impossible) to perform.

First off, you need to find the carrier. Because the carrier is moving, and your landing waypoint is fixed, the carrier will not always be in the exact spot the waypoint depicts. The waypoint will only indicate the general area. You will still need to pick out the carrier among the other ships. The easiest way to do this is to use your radar and lock on to the Tarawa (just don't pull the trigger!), then follow the target vector right to it.



Next, always make your approach from the rear. This sounds simple, but you'd be surprised how many new pilots don't realize that the carrier is moving. Then, don't try and hover. Speed is relative to something (e.g., air, ground, etc.). Since the Tarawa is moving, if you match the speed of the carrier you will appear to be hovering in relation to it. However, to approach the carrier, you will need to be flying faster than the carrier. A comfortable approach would be to fly toward the carrier at 75′ MSL at a constant 40kph. As you get very close to your chosen landing pad, slow to 22–25 knots and reduce collective. When you do, you will need to apply forward stick to maintain airspeed. Use rudder to maintain forward orientation and cyclic to overcome side-to-side motion. Once you hit the deck, apply your brakes. Simple, but it takes practice.

AIR THREATS

It's debatable which threats (ground or air) are more deadly in *Apache*. When the enemy logic is set to the lower levels, ground threats pose more of a problem than the rather anemic air threats. However, at the highest enemy AI level, air threats are unrealistically

deadly. Numerous enemy aircraft seem to pop up out of nowhere as soon as you get the "mission complete" audio message. Not only do they carry extraordinary weapons loads, but to make matters worse, they're all targeting you! While it is challenging, to say the least, you should be able to complete most missions at this level.

DEFENSIVE STRATEGIES

There are two general strategies regarding any threat, and in order to survive and be successful, you will have to learn and make use of both of them. As was mentioned earlier, one is to try and not be seen. If they can't see you, they can't shoot at you (or at least hit you as they proved in Baghdad a few years ago). The second is to take out the threat before it can take you out. Ever heard "the best defense is a good offense?" This is the same idea.

Countermeasures

In most sims, ECM (Electronic Counter Measures) can be tracked by the enemy. *Apache* has what is called automatic ECM mode. There isn't much written about it or whether or not it can be tracked in auto mode, Mike Chen from Interactive Magic says that if you turn it off, it makes it harder for the enemy to see you. Most who've tried it either way haven't noticed any difference. It probably doesn't hurt to turn it off as long as you remember to turn it on when needed.

Missiles and SAM Evasion

Of course, avoiding missile fire in the first place is preferable. Sometimes despite your best efforts, the enemy will fire one off at you. Regardless of the ECM auto/manual controversy, you will likely notice a difference when you set the other countermeasures (chaff and flares) to manual. Without going into any details of how missiles track and the theories involved with evasion, let's get to the nuts and bolts. An Apache helicopter doesn't fly fast enough for you to out-turn missiles with any regularity, so you need to use standard missile evasion tactics.

First determine where the missile is. Apache's communications data panel will list the incoming missiles' time to impact. Also, the TSD can provide direction information. If you have to time to perform it, the best method of spoofing missiles fired at you is to do the following: Turn directly into the direction of the missile. Drop countermeasures (such as dropping chaff and flares), and turn on ECM if you have it in manual mode.

Immediately after applying countermeasures, make a 90-degree turn in any direction. However, be aware that if you decide to turn into a steep climb (which technically can be considered a 90-degree turn) you will attract other weapons' fire as you will now be easier to spot by the enemy due to your increased altitude. As a final measure, drop countermeasures a second time. Check the TSD and see if the missile is still tracking you. If it is, better try the procedure again!

The above is a best-case scenario. You will undoubtedly at some point have missiles or SAMs fired at you when you don't have time to perform all of the procedures. At the very minimum, drop countermeasures and turn a hard 90 degrees from your present heading, and then drop countermeasures again.

NOTE

While flares won't work for radar-guided missiles and chaff and ECM won't do diddly with IR missiles, you rarely have time to decipher which is appropriate; so just drop both. Don't worry about conserving your countermeasure stores, 10 chaff and 15 flares left over are of no value to you if you get killed before you use them.

ON THE OFFENSIVE

Planning is very important when preparing for a mission. First and foremost, know that the enemy is colored brown, and friendlies are green. Study the manual and learn which aircraft and ground units are strictly enemy only (like the SCUD). This will allow you to bypass risky visual inspections before shooting some targets. The use of radar masking can help sort out the confusing display; however, be aware that you will never see your intended target of D30 artillery or trucks, for example, if you stay at the high masking setting.

Which Weapons

Another important consideration is your weapons load. Read your mission briefing carefully. Your targets will dictate which ordnance is appropriate. One tip that actual Apache pilot Rex Swetman passed along is to choose B (Bravo) version of the Hellfire missiles instead of the A (Alpha) version. This is a good tip for several reasons. The Bravo has a longer range (5.5 miles vs. 3 mile Stingers), is radar guided, is *fire and forget*, and last but not least, can be used against slower air targets.

Rocket Ranger

While it may seem obvious to lock on to a target before using rockets to take advantage of the automatic pod elevation, learn to fire rockets manually. It's a handy skill if you fly with radar off or if it becomes damaged.

Fun Gun

The 30mm chain gun in *Apache* is awesome. It is the weapon of choice for very close, tightly packed enemy targets. Although the gun range is listed as 4,500′, you can take out targets as far away as 6,000′.

Obscured Vision

Because the enemy rightfully doesn't want to get shot at, it hides behind things like trees and buildings, resulting in obscured targets. Rather than waste missiles on these obstacles, use the chain gun on them to clear the way. Take advantage of the fact that the enemy isn't smart enough to know that the trees in *Apache* are explosive.

Mountain High

Some sim'ers have complained that there isn't enough terrain graphics around in order to judge just how high they're flying. (Could their altimeters be out of order?) One tip is to watch where you place the aircraft datum over the horizon when climbing over mountains. As long as that datum is over the horizon (and you're flying forward), you'll never hit the ground.

CAMPAIGN & ADVANCED SKILLS

As you may have found out already, flying in arcade mode is fun for a *quick fix* of blowing things up into little pieces, but sooner or later you'll be ready to get into the meat

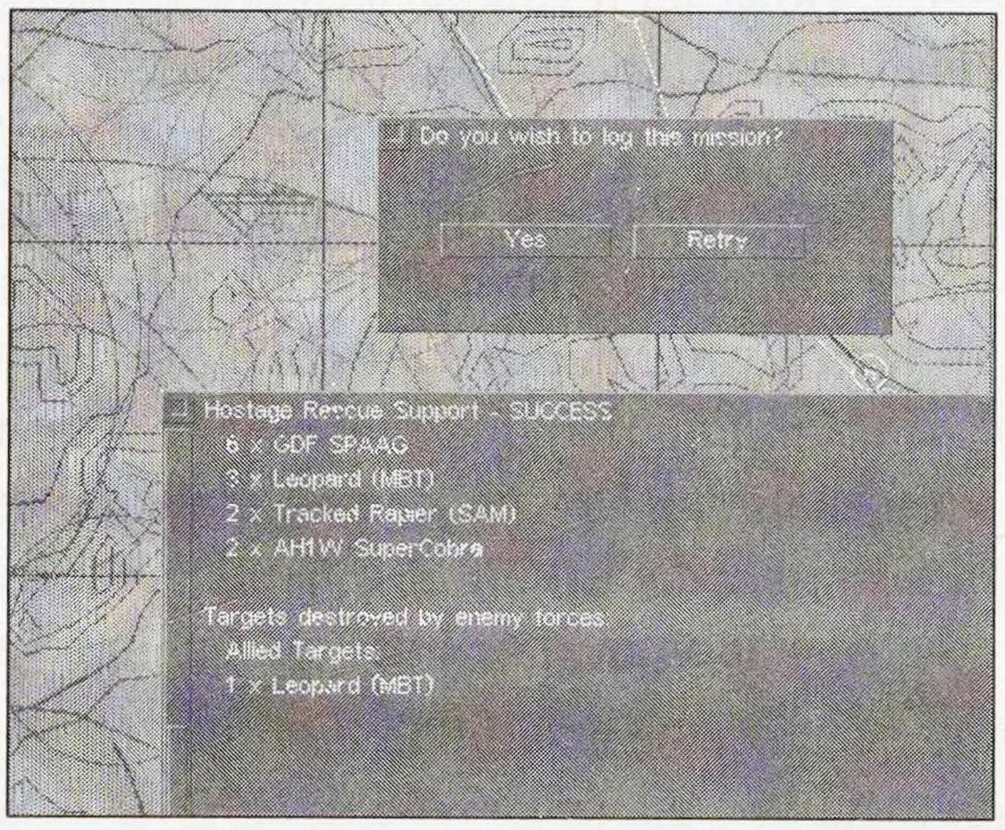
of *Apache*—campaign mode. Here are some tips that can help you and save you some frustration.

CAMPAIGN BLUES

Single mission and campaign modes are basically identical in form. The actual missions may be different, but what you have to do is pretty much the same in each. So much of what we'll discuss regarding missions in campaign mode will apply to single missions. The only real difference between the two is campaign mode doesn't allow you to change theaters midstream or exit (unless you know the tricks. Read on.) without consequences. As a few *Apache* pilots have discovered, if you change theaters before completing a campaign, you may not return to the campaign where you left off. You will have to start over from the beginning of the campaign! The only way to get around this limitation is to create another pilot then switch campaigns.

Try, Try Again

While some of us are happy to accept the outcome of our missions, whether they are failures or successes, most of us want to complete every mission successfully. On the higher skill levels, it's very difficult to accomplish some of them on the first try. Luckily, *Apache* gives you the chance to retry your missions without logging your failure in your log book.



Unfortunately, if you want to exit *Apache*, for whatever reason before the successful completion of the current campaign mission, you only get the option to retry or log the mission.

One thing to be aware of when retrying missions is that if you changed your weapons load earlier, when you retry the mission, it will return to the default load.

TIP

By pressing Alt+X, you can exit the program and restart again where you left off, thus leaving your perfect record in your log book intact.

You will have to change your weapons again every time if you wish to use your previous weapons load.

On the Campaign Trail

Although it is hard to distinguish, the elements (enemy and friendly traffic) that are found inside the missions are not exactly random. Within mission scenarios, these elements all start in a same, set position every time. However, once the mission starts, the elements take on a *free form* AI. In other words, they do what they do based on a combination of what you do and what happens in the mission. This gives the appearance of randomness, and once you're aware of this fact, it can be used to your advantage.

X Marks the Spot

You can always count on the mission targets being where they were in previous mission completion attempts because the starting positions of these elements remains the same. However if you fail a campaign mission and exit (with Alt+X), switch to single missions, and choose another theater and exit, when you re-enter to try the same campaign mission, you'll get another mission. This can sometimes help you or hurt you. You can try this trick again, and sometimes it will switch missions again. This *sometimes* occurs because it doesn't always work on the second attempt for some reason. However, you can exit out to DOS and re-enter *Apache* and the missions will switch.

The mission briefing screen will tell you what the mission is and approximately where the targets are. However, many times pilots neglect to notice what the targets are. Be sure to press the BRIEFING button. This will reveal your targets. Note that they are always located at waypoint X, Y, and/or Z without exception.

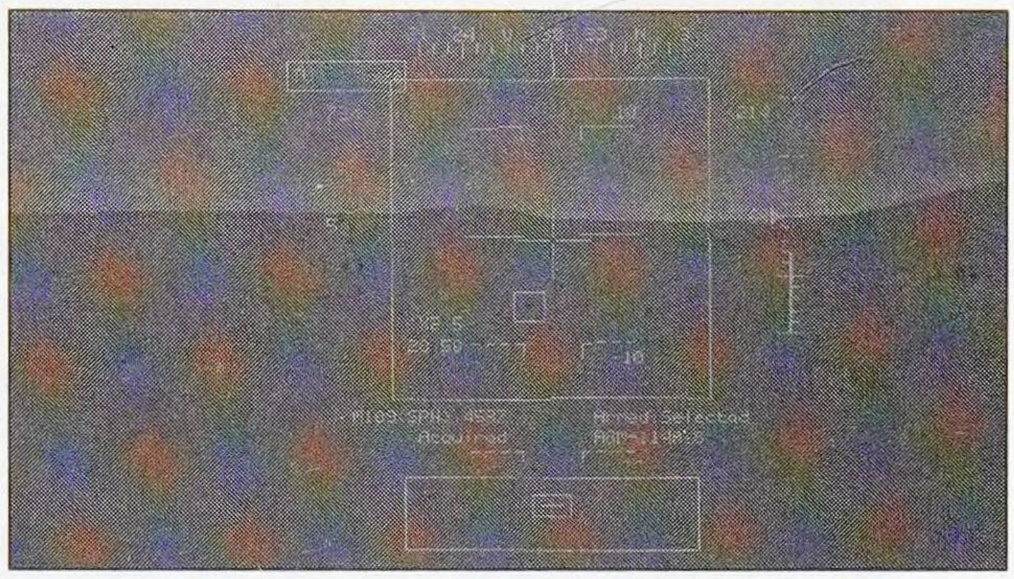
Friend or Foe

The Apache does not have Identify Friend or Foe (IFF) equipment. Therefore, you have to figure out who are the good guys and who are the bad guys all by yourself. Here are some hints to help you avoid friendly fire and civilian casualties.

- Study the vehicle inventory in the back of the manual. This lists friendly and enemy vehicles. It's very effective until you try the Cyprus campaign, where the enemy has a lot of the same equipment.
- The only absolute way to tell who's who is to visually identify your

targets before firing on it, however, this is undesirable because it means you have to get close.

- Enemy vehicles are tan/brown.
- Take advantage of the long-range viewing abilities of the TADS Day T.V. (DTV) and Direct View Optics (DVO), if you have enough light to make out color.



- The Forward Looking Radar (FLIR) is useless because it can't distinguish color.
- Limit your firepower to things near waypoints X, Y, and/or Z to increase the probability that your target is an enemy.

If you're still in doubt of a target, don't fire at it unless it shoots at you.

Solo or No?

There are two schools of thought regarding strategies for staying alive en route to your mission objective. One way is to fly in formation with your flight of choppers. The theory is that if you're in a group, there is a less likelihood of you being singled out. The other strategy is to set your own waypoints and go at it alone *Rambo* style.

One strategy seems to be better for some missions and the other seems to be easier for the other missions. Generally, if you make your own waypoints when attacking targets with heavy anti-aircraft protection, you can let your flight get pounded first and later waltz in and sweep up.

NOTE

No matter where you set your new waypoints, the other members of your flight group will follow the default nav points.

This strategy is not very heroic, but if you really must win a particular mission, you'll do what you have to.

ACM

The Apache helicopter is capable of performing some non-standard helicopter flight maneuvers such as loops and rolls. If you add these to your Air Combat Maneuvers (ACM) repertoire, they can be very helpful in certain situations.

Loops can be very effective against other helicopters when they sneak up on your tail. The Apache will do loops when the other helicopters can't. They allow you to get on the bandit's tail faster than trying to out turn them. It almost makes it seem unfair!

It's pretty tough to maintain a low altitude in the heat of battle. Air-to-air combat catches many proficient pilots off guard at a higher-than-comfortable altitude. If your air speed is pretty high, losing altitude quickly is as easy as pushing the cyclic full forward. However, if you're at a low air speed, such as after a turning fight, rolling inverted and using the thrust from the main rotor in addition to gravity will get you down in a hurry. It is much faster than chopping off the collective and/or pushing the cyclic full forward. Just remember to roll upright before you turn your Apache into a rototiller!

Torque turns are great for certain situations that require you to remain moving (to minimize the holes in you and your helicopter) but have a limited area to do so (see Figure 3.4). There is one mission in the Cyprus campaign where you must destroy a tank column hiding in a box canyon that is a perfect example.

MISSION UNDER FIRE

Now it's time to put your training to the text. Let's look at what you can do during the Cyprus Campaign after about 87 percent of it is completed, when the Turkish armored attack has broken the allied defense of a small length of the front line and is directly threatening the base. You must immediately scramble and counterattack before you and your helicopters are destroyed on the ground. Enemy AI is set to maximum. It's all up to you!

MISSION BRIEFING

You're under attack, so there isn't much time to fuss with details. Just take a quick look and note that the mission targets are tanks, APCs, and air defenses. Go with the default weapons load. Normally, if you had time you'd swap the Alpha Hellfires for the more capable Bravo versions.

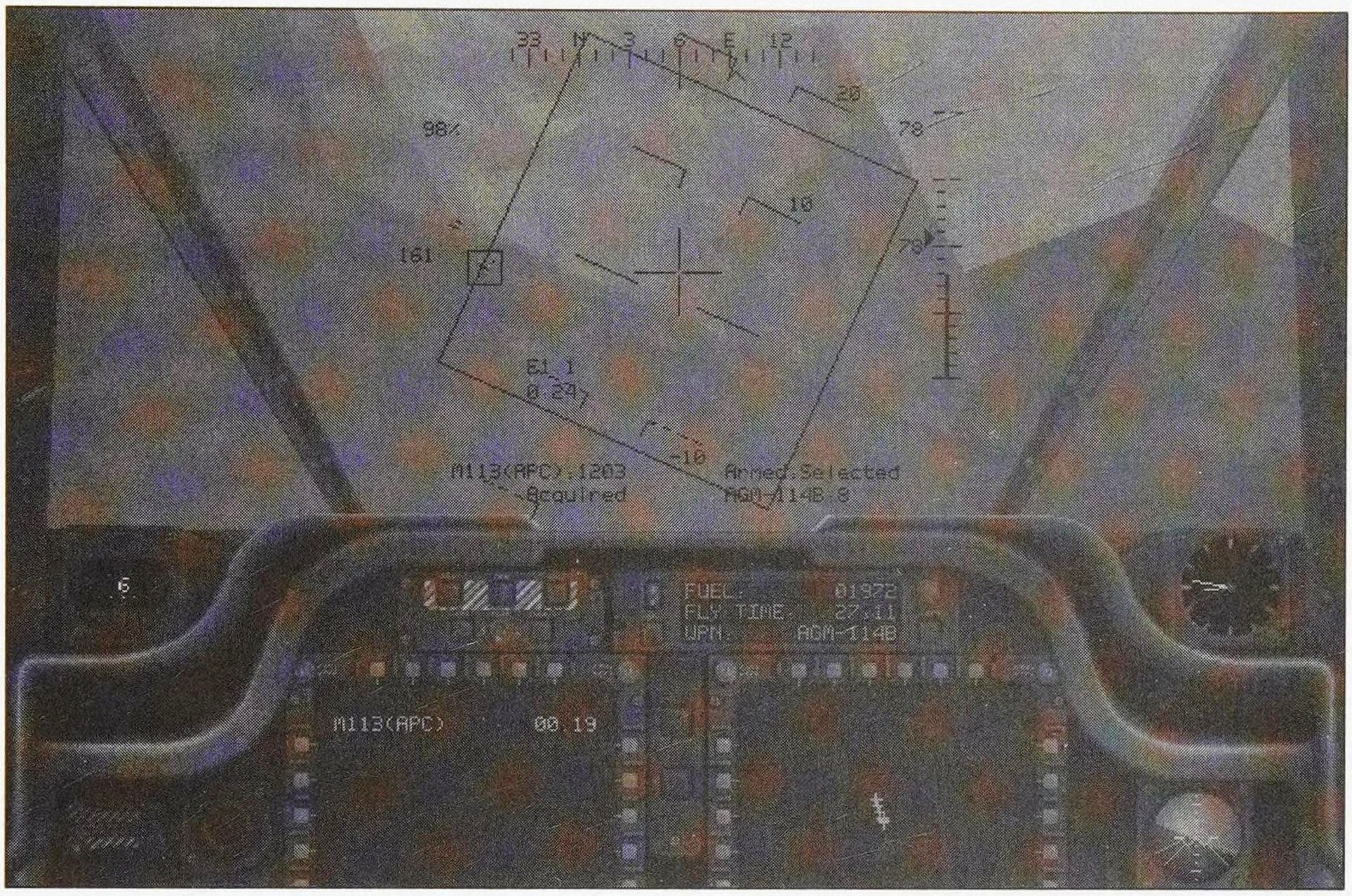
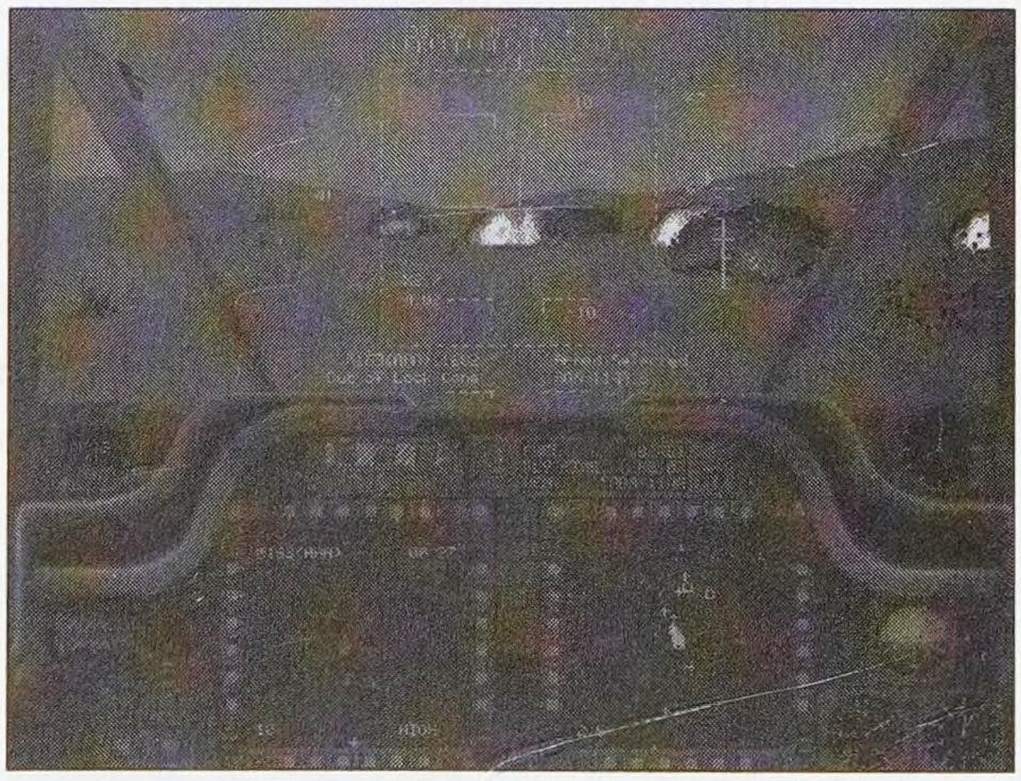


FIGURE 3.4: Torque turns are invaluable in missions where your targets are held up in a box canyon.

SCRAMBLE INTO THE STORM

You've got incoming shells! Get this crate off the ground! Pull the collective full up and back it down to 75 percent once you're airborne. Quickly cycle your right MFD to TSD and set your left MFD's ground radar to High masking. Stay with the rest of the flight. There's safety in numbers in most situations.

On strike missions you'd usually switch the radar off and fly below 100′ AGL so as not to attract attention. However, because the enemy knows you're coming, switching radar off won't help as much. In this situation, the best defense is a good offense. In order to hit the Turks hard at waypoints X, Y, and Z, you'll need the attack radar on. The key is to hit them before they can strike at you. Remember, fly low so as not to



attract SAM fire, and pick your targets carefully. Your priorities range from mission targets to those which are most dangerous to you. Since SAMs and air defenses mission targets are also dangerous to you, concentrate on these. The High masking setting is perfect for this. Leave the tanks. You can always mop them up later, if you have ordnance left.

Okay, the first waypoint is X. A lot of the equipment that the Turks have in Cyprus is identical to yours. All of those hours you've spent studying the vehicle inventory will now pay off, but you'll still have to stay on your toes. A good rule of thumb is to be extra careful when attacking targets outside of the attack waypoints (X, Y, and/or Z). If you're in doubt, don't fire unless you're fired upon. If at all possible, get a visual on the target. Our guys are green and the enemy is brown. Any friendly fire is unacceptable. Target enemy AAA, Rapiers (that's right, the Turks have acquired Rapiers) and APCs in that order with the Alphas. Since you're going straight in and you're still quite a ways out, the Alpha's will work as long as you keep them locked on the target until it's destroyed.

Give it some more collective and push forward on the cyclic. Your flight is getting too far ahead. Watch out for that ground fire! Flying more or less directly at AAA sites will allow you to see their tracers. When you hear ground fire or ground fire warnings, jink in any direction, as long as you move from your current flight path. You can dive or climb, but keep your jinking climbs to a minimum as SAMs are lethal. You can live through a couple of AAA hits, but SAMs will take you out. If you're locked on a target with an Alpha, you can jink, but you should try and keep lock. Good Hellfire!

INTO THE THICK OF THINGS

Your flight kicked butt on waypoint X; next up is waypoint Y. Looks like the Turks are dug in deep in that little town ahead (see Figure 3.5). Temporarily switch your right MFD flight plan mode. Notice that you're going to have to fly past that town.

You've got a problem here. Unless you're able to route those guys, you'll be setting yourself up for a rear quarter shot after you fly by. Try and lock some of them up. They're dug in pretty well. Those targets are obscured. Switch to the chain gun and hold your fire until you're about 6,000′ away, and then let that bad boy sing. Just let the auto targeting system do it's job, and those buildings they're hiding behind will be Swiss cheese in a second. Keep an eye on the target status display on the IHADSS. No use wasting ammo on targets too far away to hit.

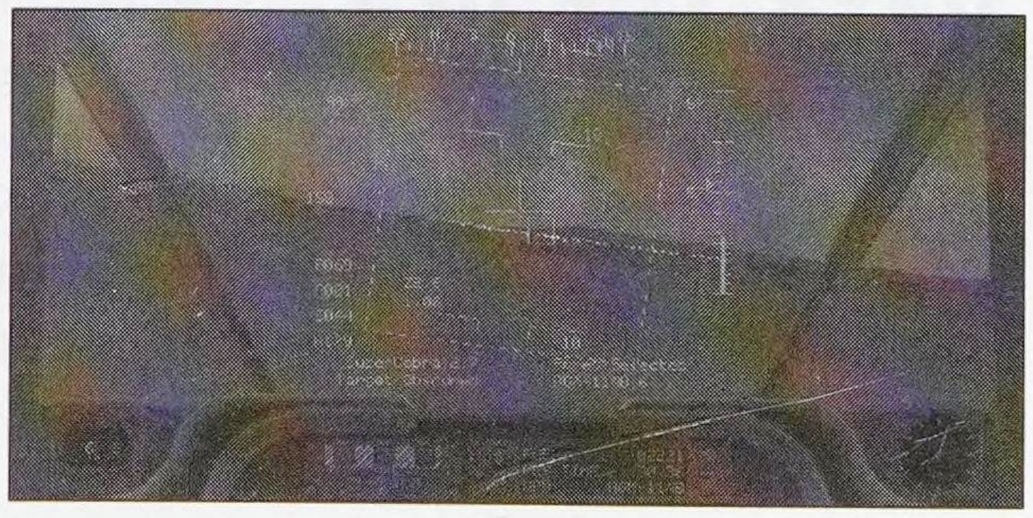
FIGURE 3.5: With those targets obscured, switch to the chain gun and hold your fire until you're about 6,000' away.

Excellent! Looks like you got them all. All right Hot Shot, make your turn to head toward waypoint B. Watch your altitude and for God's sake, don't hit those trees with your main blades! Yeah, you're doing well, but don't get cocky.

Things are Looking Up

Turn to waypoint C. Cycle through targets until you see something worth hitting. There ya go, a convoy of brown trucks ahead on that road. Hey, there's a GDF(AAA) ahead. You can probably lay odds that those APCs next to it are Turkish also. They're all pretty close together, hit 'em with the chain gun. Rock and roll! Mission accomplished!

Now get home in one piece. Switch to air radar. The enemy usually sends up everything they've got right after you've completed your mission. Forget about the F-16s and C-130s and worry about the SuperCobras. Incoming missiles!



Manually drop chaff and flare and jink. Don't forget to finish off with chaff and flares again. Good spoof, good spoof!

You've got one on your tail! Pull up into a loop, roll upright, and fire a Stinger at him. Good kill, good kill! There's two more coming in. They're still a ways out, welcome them with a couple of Bravos. Got one, but the other is coming around on your tail. Pull another loop and polish the other one off with the chain gun. More missiles incoming. Nice moves, now get that SuperCobra! Down in flames, got him!

No time to rest, you've got SuperCobras ahead at that airport. That's where they're all coming from. Switch to Bravo's and let 'em have it. You've crippled them pretty well and can probably stay ahead of anything else they may be able to get off the ground. If you think you need to, you can switch your radar masking to Medium and locate SuperCobras on the ground.

A Final Strike

You're not out of the woods yet. Waypoint Z is just ahead. Same routine here. You've gained some altitude in that air-to-air engagement. Hit the deck and hit 'em hard and fast. Try and lock on as far out as possible. After this waypoint, you'll be on your way home, so don't worry about saving ordnance. Let 'em have it. Good Hellfire!

On Your Way Home

Hey, there's your flight! Looks like two of them made it through. Hope downed crew is all right. Form up with the others, and you're home free. Flip back and forth between ground radar and air radar. You don't want to get jumped from behind.

Home sweet home! Just let her down easy. Outstanding! That's the way to fly a mission! You lost one Apache, but the mission was a success and you've destroyed an outstanding number of targets.

FOR OVER THE NET

Apache's multi-player modes consist of two cooperative campaign modes and a *DOOM* "Deathmatch" style head-to-head combat mode. With all of the hiding and sneaking around that can be done in *Apache*'s head-to-head mode, it feels and plays more like *DOOM* than the *hair on fire, major pucker factor Falcon* duels. Regardless of how it

feels, just as with other games and sims, multiplayer modes increase your investment by allowing you to enjoy your purchase for a longer time. Generally, after months of playing the same old thing, jumping into multi-player mode will make it feel like an almost totally new game. Without a doubt those regular *Over The Net* fans know this experience well. If not, here are some tips to get the rest of you started.

An *Apache* Peeve

While *Apache* is way cool, there is one thing about it that really bugs a lot of players: There is no coms mode. Interactive Magic has stated that the "lack of a player-to-player communication system was a design decision." Their "main priority was to keep frame rate up," and a com system would have degraded it. This sounds good, and it isn't a problem if your opponent/partner is sitting in the same room right next to you. However, you'd think there could have been some sort of canned messages or chat mode included during the connection setup screens. At the very minimum, it would do wonders to be able to tell your opponent/partner "hey, last game" rather than to just abruptly disconnect when you have to quit.

MODEM MADNESS

Apache supports serial/modem connections as well as IPX networks. Right now, modem and direct serial connections tend to be the most common because not everyone has access to a network. However, for those players who have seen the *other side* (networked), the limitations of modem/serial connections are woefully apparent. First and foremost, you're limited to only two players. This is not unusual for most multi-player modem games not connected to an online service. Second, modem mode performance is inconsistent and choppy. Unfortunately, turning down the graphics detail will not help frame rate.

Far and away, the best performance to be had *sans* an IPX network, is a direct null mode connection. (You can buy null modem adapters for a few dollars at Radio Shack.) If you are playing with this type of configuration, have the slowest computer (CPU-wise) connect first (have the slowest be the caller) and press Ctrl+Esc to re-synchronize with the other player if you get out of sync. Also note that *Apache* needs to run properly before attempting a multi-player game. Most problems are caused by not having the required 24MB of free disk space.

Network Worries

Apache runs on a standard IPX network. However, players have reported inconsistent results when running *Apache* with IPX drivers and IPXODI drivers. As with the modems, it's better if the slowest computer joins the melée first.

H2H

Combat mode in *Apache* is like playing *DOOM* in Deathmatch. You can play it as a free for all (kill or be killed) or in makeshift teams in network mode.

Hill to Kill

When you start off in two-player mode, you'll be facing your opponent, but you won't see him visually or on radar. That's because he's behind that big hill in front of you. You now have the choice to climb over the hill or go around it. Climbing over the hill is very dangerous when your opponent knows approximately where you are. Since you just started the match, make no mistake, he knows where you are. There is a couple of problems with climbing that hill and hills in general. One is you'll lose air speed when climbing, so you'll also lose maneuverability. Next, because one side will be now taken up by the side of the hill, and below you is the ground (actually the hill again), your maneuvering space is severely limited. If you get caught on your ascent up a hill, you're basically a sitting duck.

With so many problems associated with climbing up a hill, why even bother? Because it's the high ground. There is a tactical advantage to being up there. You can fire on your enemy below, and he has no place to hide. You, on the other hand, can duck behind the ledge making you impervious to radar and missile fire from below.

Land Slow!

Head-to-head combat and network mode has a *no crash* option. This means that while you can never destroy yourself by flying into the side of a hill or land with too much vertical velocity, you have to be aware of the drawback. To reload and repair damage to your chopper in head-to-head/network combat mode, all you have to do is land. However, with the no crash option turned on, you still have to land within landing parameters in order for this to happen. This means you have to slow down. If you find

that you've landed and things didn't get repaired, you'll have to take off and try it again. Just watch out for incoming missiles and gun fire. You're a sitting duck again!

Co-op Cop

There are two co-op modes. Co-operative pilot/gunner mode and co-op campaign mode. Unfortunately, these are only available in two-player mode. Co-op campaign mode makes the canned missions much more interesting. Team work can really get you pumped up. It is best to assign certain duties to each player. While these assignments are very relaxed and anyone is free to shoot at anything they feel like, the basic idea is to have someone worry mostly about mission objectives, and have someone worry mostly about air targets, and so on. You can also toy with sending one player according to the pre-planned waypoints and having the second player flight fly in from a flanking direction. The combinations are almost endless.

Front Seat, Back Seat

The gunner/pilot arrangement is probably the most realistic in terms of how the real Apaches are flown. Basically one player becomes the pilot and the other becomes the gunner. While being the pilot doesn't really add anything new to the sim that you haven't experienced in single-player mode, flying in the gunner position is something else. There is nothing quite like being chauffeured around at 160KPH, 50′ AGL while you hunt down targets, as you can see in Figure 3.6. It's quite exhilarating.

The best part is that now that you don't have to worry about hitting the ground (depending on your pilot, mileage may vary) it actually makes IHADDS helmet mode usable, deadly, and fun! As the gunner do not worry so much about targets on the sides of you. Worry about where you're going rather than where you've been. Those are the guys who will have the best chance of shooting both of you down. That is, unless you're talking about a primary mission target. Get those at all costs.

Fly low, shoot often, and have fun!

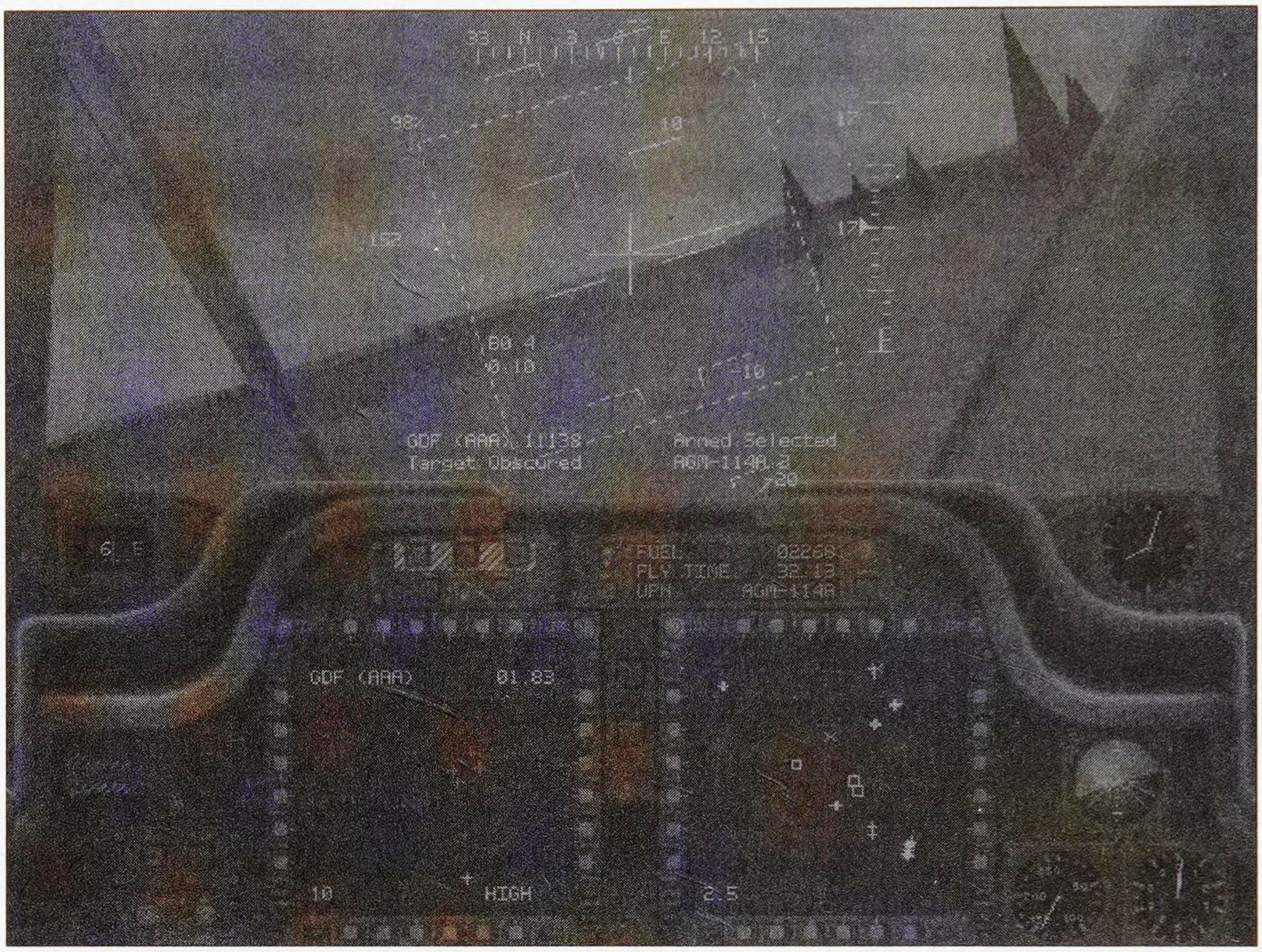


FIGURE 3.6: The best part of the gunner/pilot arrangement is that all of the IHADDS helmet mode becomes usable.

4

Advanced Tactical Fighters

Electronic Arts' *Advanced Tactical Fighters* is the sequel to *US Navy Fighters*. Like its predecessor, *Advanced Tactical Fighters* has superb graphics, but it's the campaign feature that keeps players parked in front of the monitor. Two campaigns, Egypt 1988 and Far East 2002 each have 40 different missions. Because the heart of *ATF* is the campaign, let's take a look at strategy and tactics that will help make you a major success as a player.

LISTEN UP, ROOKIE!

When you begin a campaign, you'll see a mission briefing screen. A summary clues you in with an overview of each mission. Pay particular attention to the mission objective; success depends solely on accomplishing it and returning safely. Know what you have to do, and don't allow yourself to be distracted—this isn't an arcade shoot 'em up. Be alert to the nature of the threats en route to and around the target area. You'll have to avoid or neutralize them to be successful.

Despite the briefings, the missions never go as planned. If they did, you'd zip through the game in no time at all. The missions are deliberately designed so that you rarely complete one on your first pass. Expect the unexpected; smart pilots use this knowledge to their advantage. Realize that if you follow the planned routing, altitude, and timing, your chances of a

CD-ROM

Check out the CD-ROM included in this book for a video version of *Advanced Technical Fighters*.

one-pass success are low. Evaluate the objective, consider the briefed threats, and alter the plan accordingly.

The first mission in the Egyptian scenario is a perfect example. You must rendezvous with a damaged Aurora spy plane, and escort it to a safe landing. Hostile aircraft are en route to intercept and down the spy plane. Your default waypoints seem reasonable, but *you* know they are designed to ensure failure. Therefore, you had better get between the Aurora and any hostiles long before they get *tone*. Splashing the first pair won't be the end of it, so stick with the Aurora. Scan long range with radar. Ignore out-of-range hostiles, but immediately attack any that are close. Before you take off, alter your waypoint settings according to this plan. Of course, you can just fly the mission as briefed, and make adjustments on your second try!

PROPER PRIOR PLANNING PREVENTS POOR PERFORMANCE!

Now that you're convinced that following the default routing will make your job tougher, consider the alternative. Don't be afraid to make your own mission plan to the target and back.

After the briefing screens, you come to the mission map, as shown in Figure 4.1. Use the Show Menu to display all available information. Examine it in detail and decide which areas are dangerous to fly through. You can add, delete, or move waypoints to avoid these areas. Most missions have basically one unopposed route to the target; threats are normally placed on three sides. This may or may not be obvious on the map. Sometimes, only trial, error, and careful radar scanning will find the easy way in. It's best to leave the target waypoint in place, so you can find the objective easily. You'll probably want to edit the other waypoints to better suit your tactics.

Click on the waypoint and the settings appear in the Object Details panel. You can alter any or all of them. The manual gives little information about the settings; it's hard to decide which are best for each mission. The only sure thing is that the default settings will lead you into trouble; it's designed that way.

WAYPOINTS: WHAT'S IT ALL MEAN?

Your first choice is naming the waypoint. This has nothing to do with mission success, so either skip it or change it to something short and simple.

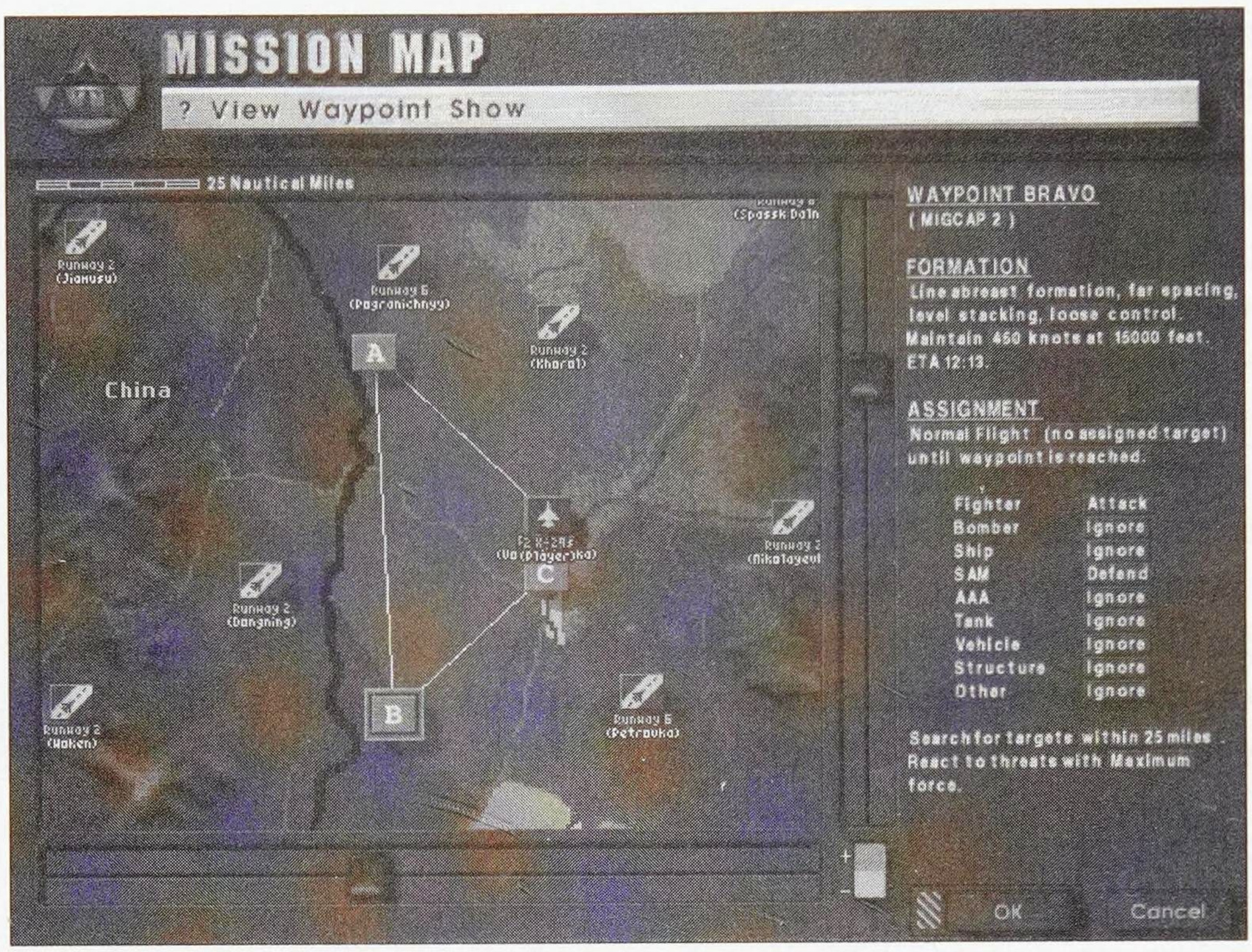


FIGURE 4.1: A few minutes spent planning here can save you an hour of flying the same mission over again later.

Next is the formation block. This one is important; the choices are line astern, Echelon, and line abreast. Line astern is of no particular benefit and the trailing plane is pretty much hung out to dry. Use this only for parade flybys. Echelon is just for looks; save it for sightseeing. Line abreast puts the power up front; it's a good attack formation for both air-to-air and air-to-mud. This is the formation of choice.

Spacing is also important. In the air-to-air mode, use far spacing. It gives your flight the widest radar scan of the sky and has room for maneuvering. Tight spacing is best for ground attack; it keeps your wingman in close and in formation. This prevents him from straying unwittingly over AAA or SAM sites.

Your next decision concerns stacking, with high, low, and level choices. Use level stacking for bombing missions. If your wingman stacks down on a low-level mission, *you* may clear the terrain, but *he* will pop up to avoid mixing the aluminum with the dirt. When he pops, he may be seen on radar. If you stack him high during low-level flights, you again make him a better target for enemy ground forces. On high altitude air-to-air missions, high or low stacks can be used. Generally, you want to mirror the bad guys' formation. Enemy pilots will usually attack with a high/low split or try to

box you in with a horizontal split. Stacking high makes it easier to keep a visual on your wingman and works well in the air-to-air situations.

Control defines your wingman's ability to initiate action. Loose control allows him to leave the formation to attack a detected enemy or break for an inbound missile. Once out of formation, he is out of your control until you instruct him to disengage. Count on him being off on his own and out of the fight when you really need him! Medium control keeps him in formation unless he breaks for a missile. This is generally a good choice when the mission is an air-to-air furball. He will engage targets at your direction and then be free to maneuver. Tight control is usually best. It keeps the wingman in formation no matter what happens. When specific targets are critical to the mission objective in either the ground attack or air-to-air mode, you can direct him to engage your targeted object. This effectively gives you more weaponry, because you are using his ordnance as well as your own.

The ability to set speed and altitude comes next. The default settings generally give you maximum cruise efficiency at the set altitude. The autopilot will use this speed and altitude to go to this waypoint. If you fly manually, these settings have no effect. Still, they are necessary because you'll be using the autopilot to lessen your workload during the mission. Before you set speed and altitude, ask yourself three questions: What's the threat? What's the target? and How much gas do I have? Adjust the settings accordingly.

If the threat is ground-based (AAA or SAM) you need to fly below the radar or above the effective range. Below the radar means as low as possible. The autopilot will accept 1,000 feet, but you can manually fly lower to lessen the chances of detection. Fly down in the weeds to avoid SAM lock-ons. AAA is usually ineffective if you're above 6,000 feet. For airborne threats, mission plan to fly above most SAM ranges (in the low 30s). This will give you some immunity from SAMs while dealing with other threats. Fly through threat areas at a high speed to lessen your exposure time.

Target type will be a consideration also. At a ground attack waypoint, you need to go down and slow down. You won't hit much from 30,000 feet or at 450 knots. With iron bombs and stand off weapons, attack from 15,000 feet or less and in the 300 knot range. If you've ingressed to the target hugging the terrain, slow to the 300 knot range and pop up a few thousand feet for a better view as you reach the target (see Figure 4.2). Unload the weapons and exit as fast as possible, as low as possible. In the high altitude air-to-air mode, start with the speed around 500 knots and in the low 30s for waypoint planning purposes.

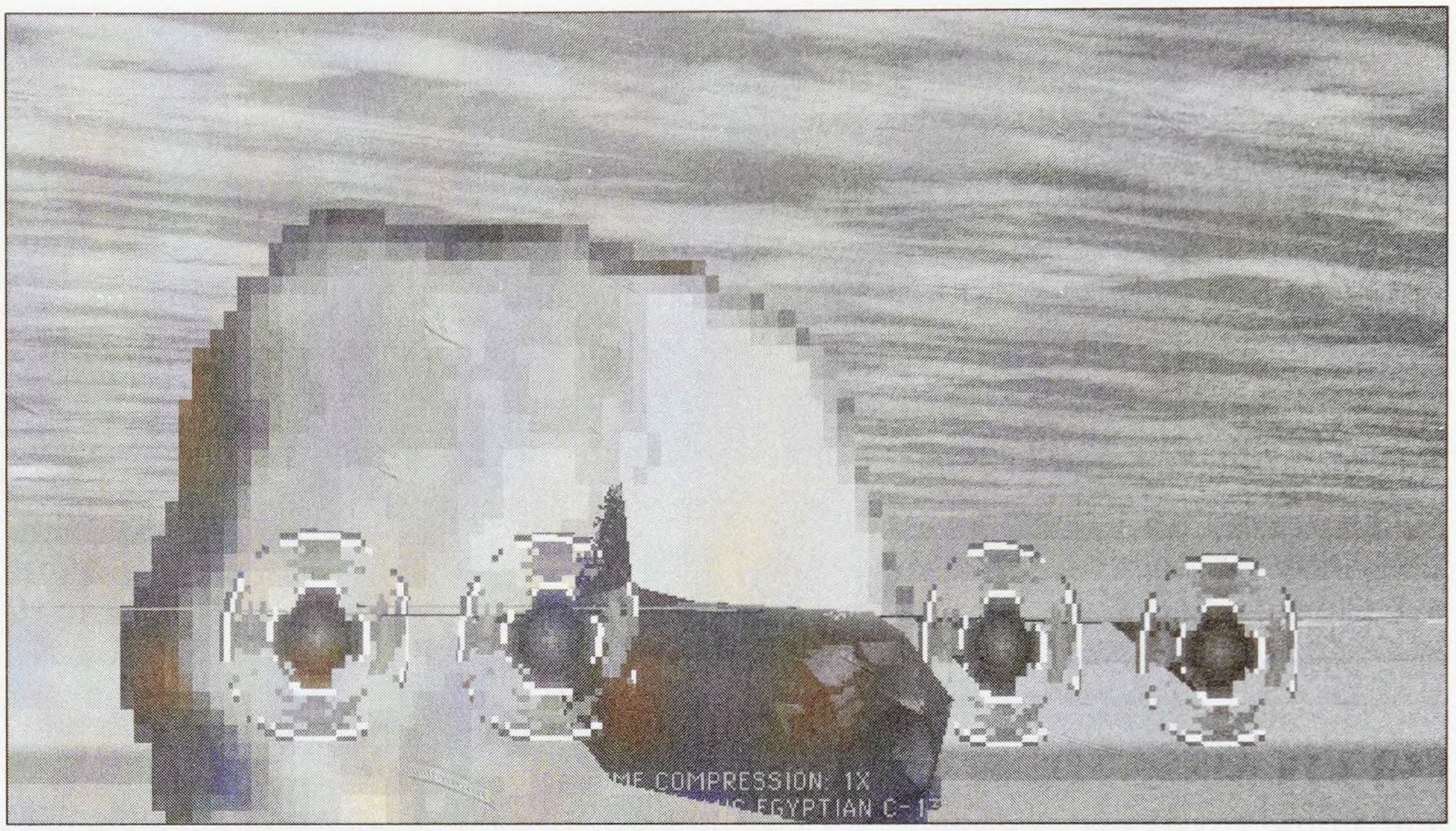


FIGURE 4.2: These C-130s are slow and easy to hit, but they'll take more damage than any fighter except the A-10.

All of this high and low, fast and slow planning must be tempered by the amount of gas you have. Check total mission flying time at the last waypoint before you start altering the mission. After the alterations, if time has increased 15–20 percent, you may need to add external fuel during weapons loading. Other possibilities include creating a shorter route or using a more fuel-efficient cruise speed. If the mission is short, like capping your airfield, reduce the amount of gas for better maneuverability.

The assignment section is next and normally no changes are needed. The default settings keep the focus on the mission objectives. Enemy fighters, SAMs, and AAA are the only things that will keep you from doing the job.

General Strategy: Focus on the Mission Objective!

Altering the waypoints takes a little time, but increases your chances of a successful mission. Avoid SAMs and AAA using altitude tactics and don't engage them if not absolutely necessary. The same goes for enemy aircraft. If you tangle unnecessarily, you waste armament. Look for a way to bypass patrols, especially if they are superior aircraft.

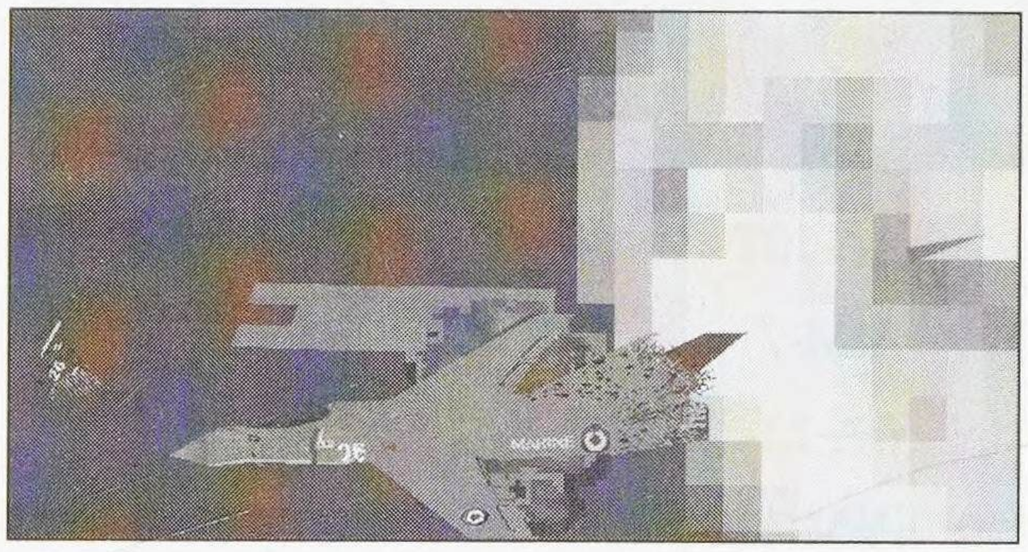
THE DAMAGING FACTS!

With superior airmanship, you've just splashed a Mig-21 and only used one AIM-9M Sidewinder to nail him. Now an Su-27 jumps you, so you quickly hit him with another AIM-9M. It doesn't even slow him down, and suddenly you're in a tough fight. What's going on here?

Every air combat simulation has rules that operate behind the scenes. These rules determine game play and the results of your actions. Here's a behind-the-scenes look at some of the damage rules for *ATF*. Knowing them will help you pick the best weapons and select the proper tactics to beat the enemy.

KEEPING SCORE BULLET BY BULLET

Every object in the game is assigned a point value. When the object is hit by weaponry, damage occurs on a point basis. When the total damage points exceed a given object's point value, that object is destroyed. Each weapon inflicts a certain number of damage points. A weapon's strength is affected by two variables: the type of target and a random damage factor.



The target type variable is a good refinement to the game. It makes a weapon most effective against the type of target for which it was designed. There are four target types: aircraft, ships, structures, and buildings. Using the AIM-9M against its intended target, an aircraft, will inflict a base value of 100 points of damage. However, use the same air-to-air missile against a ship and damage capability drops to 10 points. This is the way it should be; a Sidewinder just isn't made to sink ships.

These damage values are further altered by a random factor that may increase or decrease damage by 20 percent. This allows for the unknown factor of air combat, and adds a bit of uncertainty to those *sure things*. In the previously mentioned example, the Mig-21 has a point value of 86. The Sidewinder has a 66 percent chance of a one-shot kill on the Mig-21. By the rules of the game it will deliver either 80, 100, or 120 damage points against a target aircraft, due to the random factor. Your chances of a kill with a single Sidewinder against an undamaged Su-27 are zilch. The Su-27 has a point value

of 145, and the maximum damage an AIM-9M can deliver, even with a positive random factor, is 120.

Your cannon shells are rated for lethality as well. Generally speaking, a cannon hit from any of the available guns is going to be worth about 30 damage points. The major exception is the gun on the A-10; that 30mm delivers a hammering 80 points per hit before the random factor. You'll have to get multiple hits to down any aircraft with guns alone.

MISSILE LETHALITY AND AIRFRAME CONSTRUCTION

While listing each missile's damage capability against the four target types is beyond the scope of this chapter, here's some information that will help in loading out your aircraft. Radar-guided missiles are larger, and generally pack a more potent warhead than those with IR seekers. For air-to-air work, here's a list of radar missiles in descending order of lethality:

AIM-54

PL-10

AA-6

AA-9

AA-10T

AIM-7

AA-12

AIM-120

R-530D

MICA.

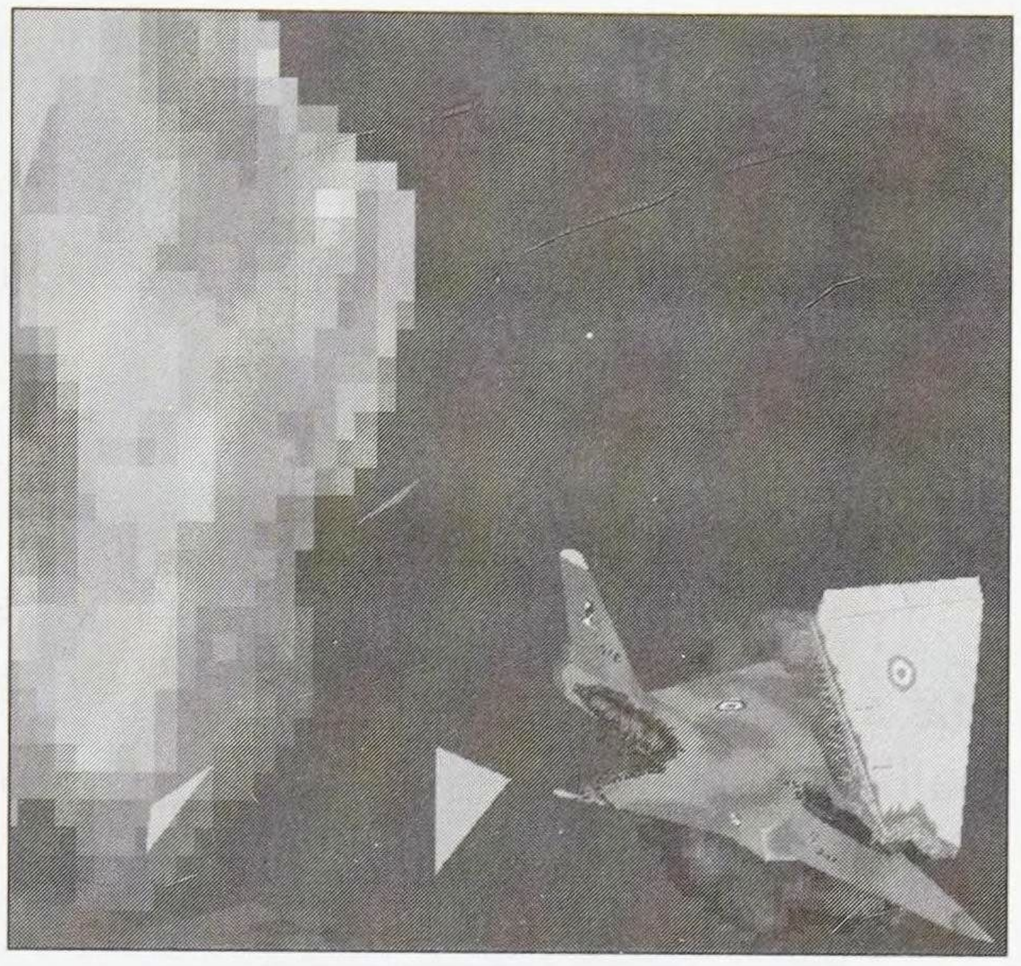
The AS-16, Harpoon, SLAM, Exocet, AS-7, and AS-15 are primarily anti-ship radar-guided missiles. They give single shot kills on most aircraft, if you can manage to get a hit, however. They won't maneuver well, but if that's all you have left, you might as well try a shot.

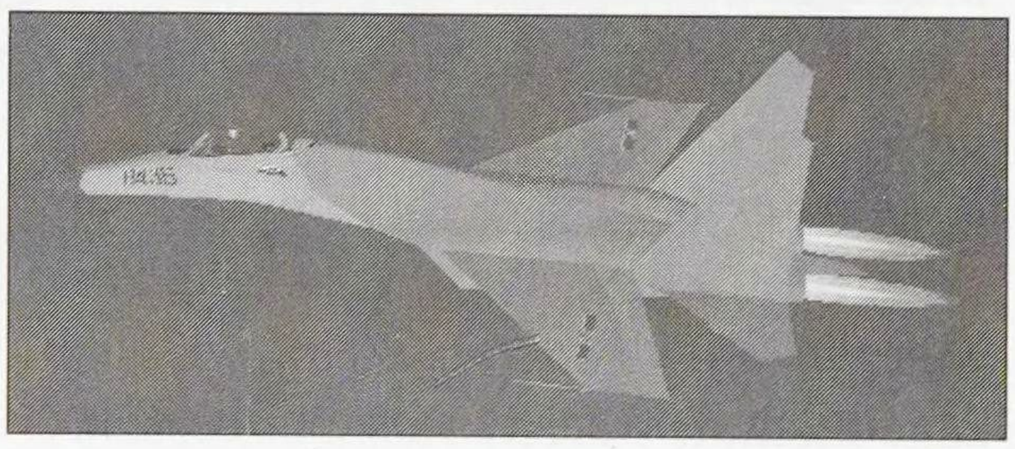
The IR missiles usually pack a 100-point punch before the random factor. That's true of the AA-2, AIM-9M, AIM-9X, PL-7 and the R-550. The AIM-9B, AA-8, and AA-11 follow in descending order. Plan on using two IR missiles for all but *light* enemy aircraft.

It will pay to know the durability of the target aircraft as well. Counting all the variants, there are 37 different types of aircraft. They can be loosely classified as being

of light, medium, and heavy construction. The light fighters take less than 100 points to kill and include the AV-8, E-2000, F-5, F-16, F-104, J-7, Mig-21, Mirage F1, Mirage III, Q-5, Sea Harrier, Super Entendard, X-29, X-31, and X-32. The mediums can take between 100 and 125 damage points: the A-7, F/A18, FS-X, Mig-27, Mig-29, Mirage 2000, Rafale, and the Yak-141 are in this category. The heavies can really take some damage. The A-10 is the toughest fighter in the game, taking 244 damage points to destroy. Others in the 126–145 point range are: F-4, F-14, F-15, F-22, Mig-31, Su-27, Su-33, Su-34, and the Su-37.

When you get your mission briefing, it will tip you to the type of fighter opposition expected. Evaluate the threat in terms of durability, and pick air-to-air missiles that are suitable for the job.





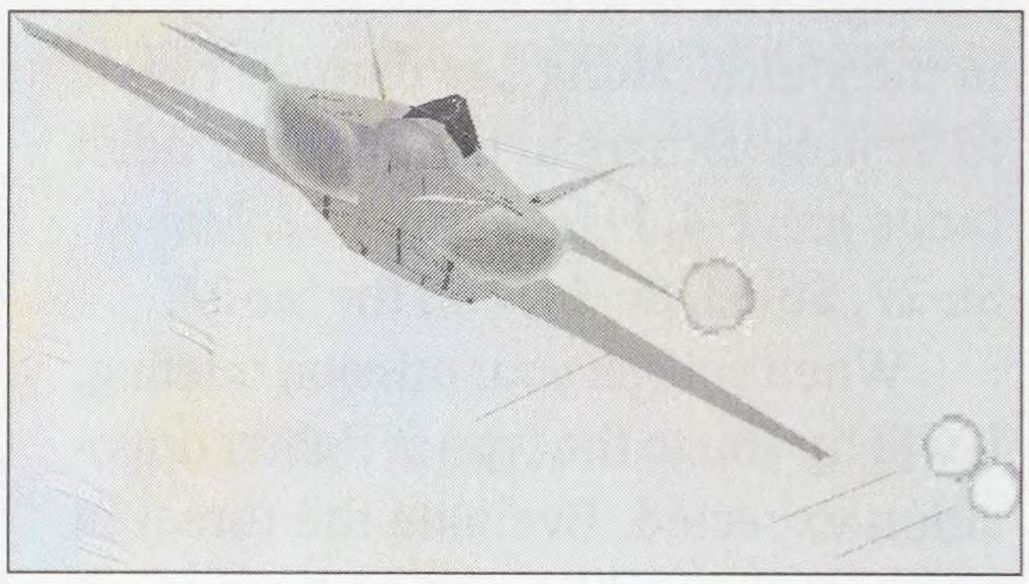
IT'S FAR BETTER TO GIVE THAN TO RECEIVE!

There's another rule aspect of damage that you need to know. While you already know it's far better to be the shooter than the shootee, you'll often be on the receiving end of a missile or cannon shell. Anytime you are hit by the enemy, your aircraft takes damage. Each hit subtracts points from the total allowable damage points for your particular aircraft. Once you lose about half of your aircraft's points, you will begin to lose critical systems such as control surfaces, weaponry, radar, and more.

Aircraft capability will degrade. When you use up all the allowable points, the next hit will likely be fatal for the aircraft. If you get the "Your plane is about to explode" message, you have less than 10 seconds to get out. A "Pilot Damage" message means the guy in the cockpit has been hit. Head for home because you have less than 15 minutes (game time) to get to a doctor. If you're warned that, "You are about to die from your wounds!" figure on less than 2 minutes to the big sleep.

Now for the bad news; aircrafts controlled by the computer do not degrade when shot up. There are no enemy cripples when you are playing against the computer. So, while you're holding a smoking wreck together with your bare hands and still shooting, a Mig with just one damage point left will be at full performance. This must be taken into consideration in furballs; shoot enough ordnance at the target to take him out before switching to another target. If you are using Sidewinders, for example, fire them in pairs before lining up another bandit. Otherwise, you may soon have a fully capable enemy on your six.

There are a few good tactics to minimize the bandit's chances of painting another star on his canopy rail. Most of the time, a computer pilot won't shoot at you if you're pulling better than five Gs or are more than 45 degrees off his nose. He also needs about five seconds for a good lock. If you get in a furball, remember that running around in burner is like hanging out a "welcome home" sign to an IR missile. Use blower only when needed to get back to corner speed. As a side note, chaff and flares are some of the cheapest things on your aircraft. Don't save them; it's pretty foolish to lose a $50 million plane while hanging on to a thousand bucks worth of chaff. If you're gonna die, Uncle Sam expects those defensive racks to be empty! Lastly, when some sharpshooter is trying to make you a gun kill, he's probably working the pipper slowly up from your tail. Jink left or right to make him miss.



SHIPS AND STRUCTURES: ABOUT AIR-TO-MUD

Ships are about the toughest targets in the game. The aircraft carriers all take 2,000 points or more to kill (see Figure 4.3). The larger combat ships—like a Kirov—will be about 2,000, and smaller combatants like a Jianghu II are 800. Even a cargo ship can take 500 damage points. Most anti-ship missiles deliver around 300 points and will require two hits to sink a cargo ship! Bombs are the heaviest hitters you can bring to the party. Mk-84s or GBUs land with an authoritative 400 points no matter what type of target you hit. The lighter Mk-82s deliver 200 damage points.

Structures are usually no problem. Most unfortified structures vanish after a 100-point whipping. A reactor generator, the toughest single structure, takes about 700 and

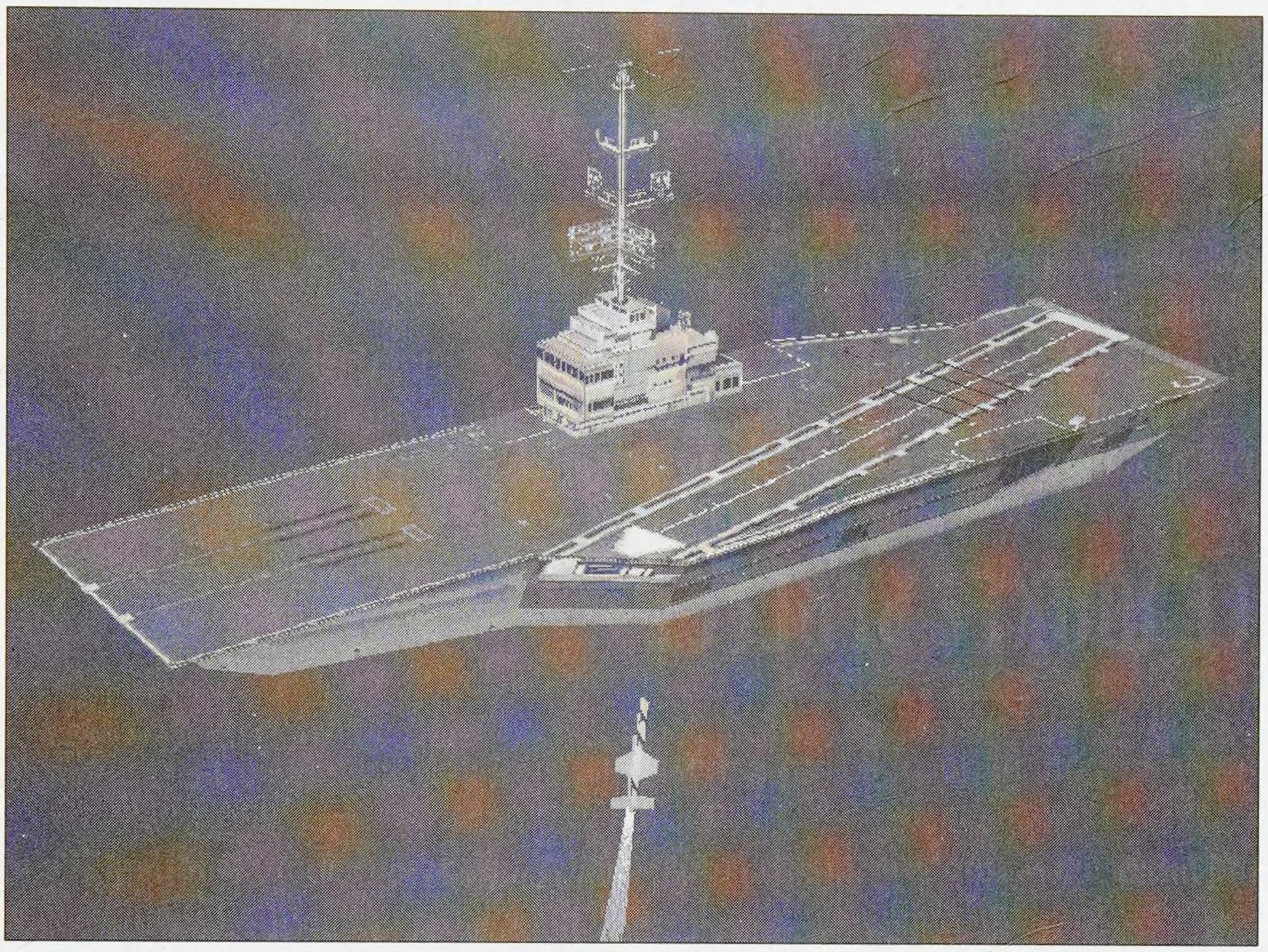


FIGURE 4.3: This 2500-point carrier can soak up eight harpoons and still remain afloat. Ships are tough!

a Command HQ only 500. Vehicles are not too tough, either. Heavy tanks take about 200, light tanks 100, and most other vehicles about 50 damage points.

Now that you know some of the rules of the game you can avoid some of the surprises. Forewarned is forearmed, so go give 'em a forearm to the face!

5

Flight Unlimited

Flight Unlimited was arguably the most hyped and long-awaited pure flight sim of 1995. Now that it's been in the hands of you ravenous air afficionados for awhile and the sheer awe of the beautiful graphics has taken a backseat to the flying, you're probably ready to start honing your flying skills to earn some of the more difficult certificates and break a few Hoops Course records. *Flight Unlimited* is about aerobatics, and aerobatics are about perfecting your flying skills.

PRACTICE MAKES PERFECT

While *Flight Unlimited* has many features that greatly appeal to the flight sim novice, the advanced atmospheric modeling makes for airplanes that require a little more attention to fly well than what casual flight sim'ers usually put into a sim. As you've probably discovered, you can't just hop into *Flight Unlimited* and earn all of your certificates. You need to study, practice, practice, practice, and then study and practice some more. It probably sounds cliché, but there really is no

substitute for practice. To quote Gen. (Ret.) Chuck Yeager, "There is no such thing as a natural pilot. Training is everything."

Competition aerobatics pilots strive for perfection, and perfection requires practice. Sorry, there are no quick fixes. Luckily, *Flight Unlimited* looks great, sounds good, and flies so well you won't mind spending hours boring holes in the sky.

HIT THE BOOKS

Read the Operator's Manual included in *Flight Unlimited* and study it. It does an excellent job of outlining what you need to know about flight physics. It's all there. However, this chapter presents a few tips to aid with your flight training and the learning process. Keep in mind that flying aerobatics requires many different individual skills. Mastering one or two will not gain you entry into club "Near Perfection." You'll need to master them all reasonably well.

CPU Blues

First, though, a few words regarding hardware: The *look and feel dilemma* rears its ugly head once again, in the form of the decision that many current flight sims make you face—fly a sim that looks good and feels bad or feels good and looks bad. Fortunately, *Flight Unlimited* has some middle ground, even if you don't have the fastest machine on the market. Its lower resolutions and lower detail settings still look pretty darn good, but in any case, even with the fastest machines, you'll have to turn something down.

On a P100 with 16MB RAM and PCI graphics card, 640×480 resolution with all details set on maximum is too choppy to fly comfortably. This is of course is up to personal preferences, so you'll have to decide what *feels* good to you on your machine. What you want is a detail and resolution setting that makes your airplane feel instantly responsive and is able to update your instrument panel gauges smoothly and instantly. If your system can't keep up with your current detail and resolution settings, you'll always be playing *catch up* and will never fly it well.

THE NEED FOR SPEED

Energy management is the most important concept and skill an aerobatics pilot needs to learn and fully understand. The *Flight Unlimited* manual again does an excellent job of describing it. So, to summarize: Kinetic energy is your airspeed; potential energy is your altitude. You convert potential energy into kinetic energy by diving. You convert kinetic energy into potential energy by climbing. The easiest-to-correct common mistake made in *Flight Unlimited* comes from poor energy management. Because altitude and speed (velocity) can be exchanged for one another (again the basis of energy management) and your flight instructor will require that all maneuvers are made at a reasonable altitude, in order to keep your energy at its highest, your only real option is to increase your kinetic energy (airspeed) before the maneuver while maintaining your potential energy (altitude).

While all maneuvers will generally benefit from this extra energy, high energy-robbing vertical maneuvers will benefit the most. It is far better to be stuck bleeding excess energy near the down side of a loop than to be hanging on the high side of a loop without any (see Figure 5.1). In the simplest terms, this means performing all maneuvers at a higher airspeed than the recommended maneuver entry speed.

How much extra airspeed is enough? Well, that depends on the maneuver. You should also know that there is such a thing as too much of a good thing. Any maneuvers that require initial diving will not benefit as much from extra airspeed as ones that require initial climbing because in a dive you'll trade off altitude and gain airspeed anyway. However, if you're at maximum airspeed before the dive, diving will most likely cause you structural failures, which is not very good for points, but it can be pretty cool that the instructor screams when your airplane breaks up into pieces!

So what's a pilot to do? Generally, the best advice is to keep as much excess airspeed that you can quickly bleed off if you need to. Flying out on the edge is fine if you can handle it. The following sections cover tips to help you keep your airplane in one piece and energy high.

THROTTLE JOCKEY

Pilots are taught that the throttle controls altitude and the elevator controls airspeed. This is easily illustrated when you're flying cross country and have the time to allow your aircraft to reach equilibrium. However, the whole point of aerobatics is to knock your airplane out of equilibrium and make it do things that it wouldn't normally do, so these

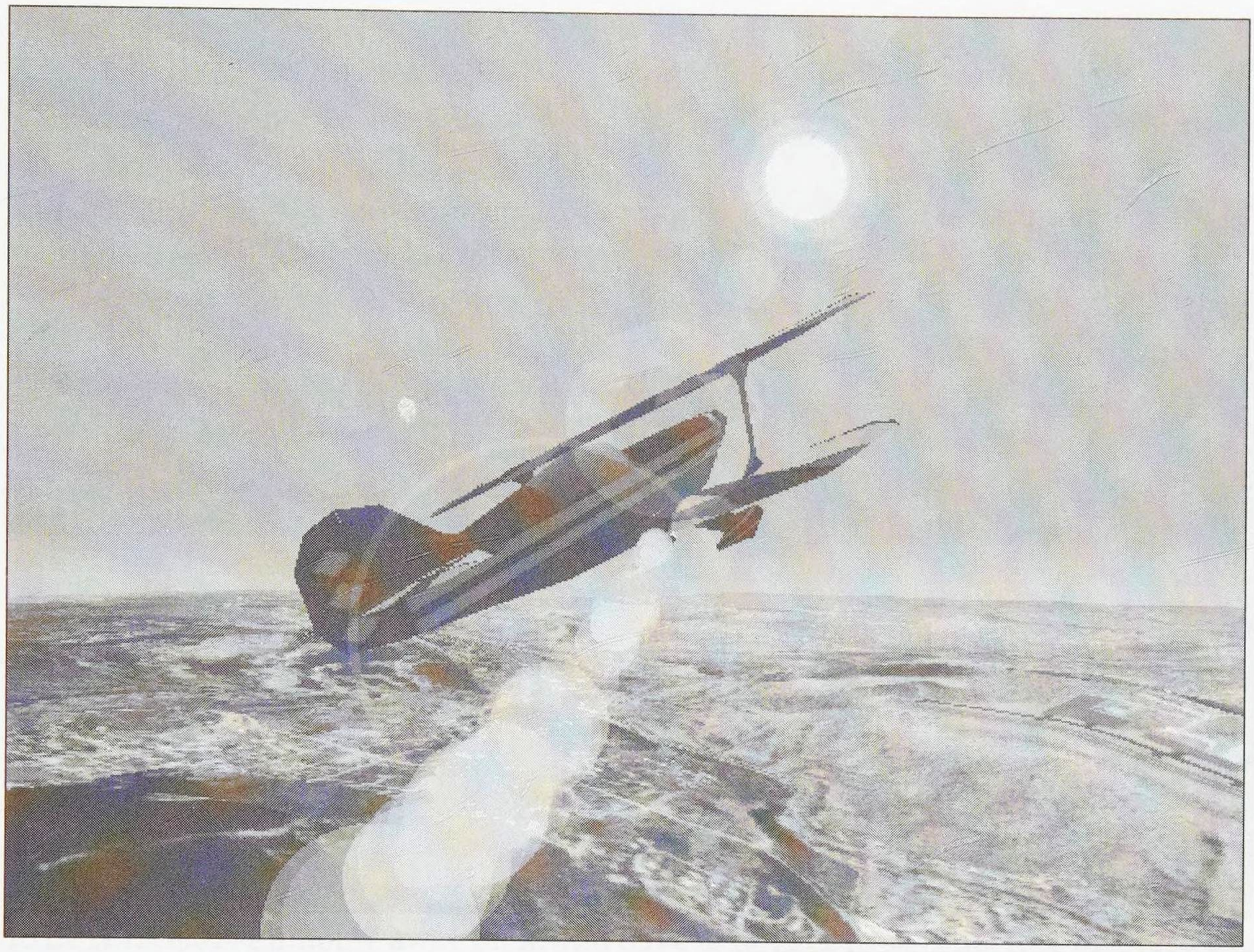


FIGURE 5.1: In *Flight Unlimited* you can perform maneuvers other sims only dream about.

same points aren't so obvious in these situations. This causes many pilots to believe that the throttle controls airspeed and the elevator controls altitude.

If you are flying level (see Figure 5.1) and increase the throttle, your airspeed will rise. Aerodynamics tells us that when airspeed rises, so does lift. This means your altitude will change. You will climb. Most pilots subconsciously recognize this, and move the stick forward to keep the airplane level. This in turn, increases airspeed. So they begin to think, "If I increase throttle, my airspeed will go up," not realizing that the down elevator they applied actually caused the increase in airspeed. The increase in throttle caused a potential increase in altitude. Down elevator exchanged this potential altitude gain into airspeed.

So, what does this have to do with energy and aerobatics? Your joystick and rudder pedals control your flying surfaces. They more or less need to follow a pattern to perform the maneuvers and patterns in the sky. Your throttle is what must be used to keep your energy up as high as possible in conjunction with what the stick is doing. Sure, there

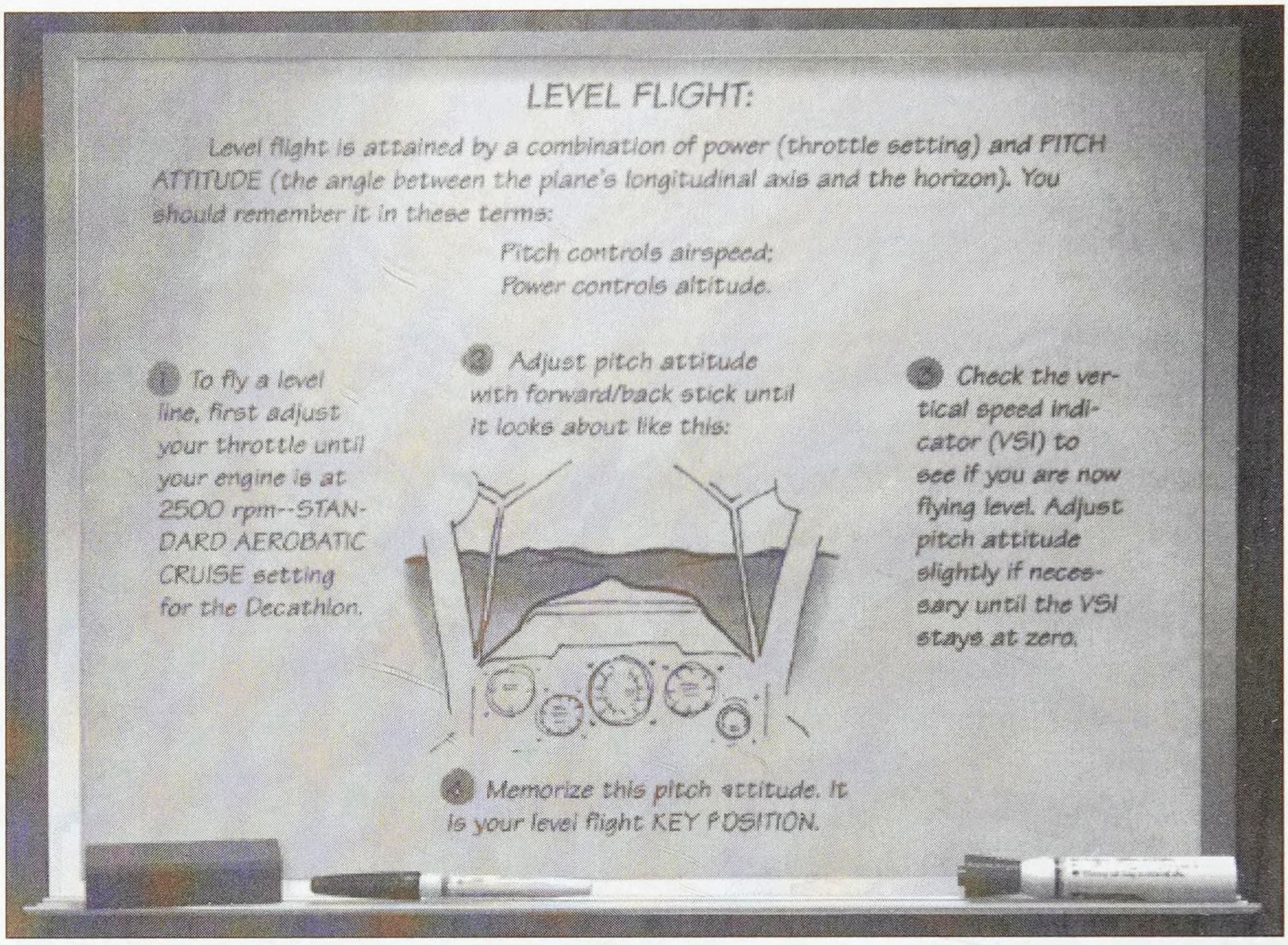


FIGURE 5.2: Some level flight pointers

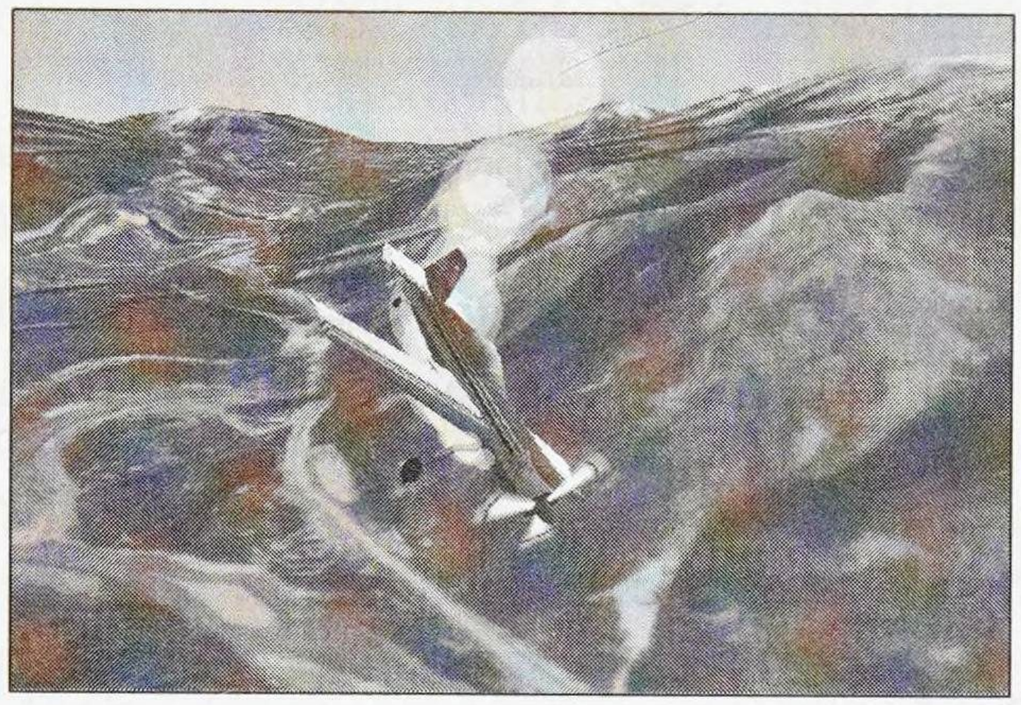
is room to fudge it a bit, and most of the time your throttle will be all on or completely off, but your throttle *will* get a workout.

Going back to the example of the max airspeed, high energy initial dive maneuver, because your stick has to follow the pattern, you have no choice but to chop the throttle to avoid breaking your airplane into tiny pieces. Slowly add throttle to keep it near the edge of the envelope, but don't cross over. You'll know when you're close. Your airplane will start to *sing*. That's the sign to back off.

SMOOTH MOVES

It goes without saying that you need to be smooth on the stick. Actually both sticks: throttle and control. This doesn't mean you won't be making many, many minor corrections. Just try and be as smooth as possible with them. Of course, it is much easier to accomplish if you have one of the stiffer sprung, high-quality joysticks like a Thrustmaster PFCS, but it's not impossible with others.

Being smooth is very important, because just as in racing cars, any excess control input bleeds off speed and energy. This is important for keeping your lines clean, your energy high, and in the Hoops Courses most importantly, your speed up. Also, if you jerk the stick, you run into a very real possibility of entering accelerated stalls. You may want that for some maneuvers, but be aware of it if you don't.



You also need to be smooth with the application and removal of power. The engines in these high-power-to-weight ratio, short wingspan aircraft can cause havoc with the straight and smooth lines you're trying to create in the sky. However, sometimes torque effects and rolls are desired. In this case, go ahead and mash the throttle through the firewall, but be aware that the Sukhoi engine rotates in the other direction!

DA RUDDER

Flight Unlimited is the most rudder-intensive flight sim around. Not only do you need to be constantly pumping away on it, you have to be accurate with it too. It should be clear that we are talking about the operation of the rudder using a rudder pedal controller and not the keyboard. If you don't have a set of rudder pedals and you're serious about flying *Flight Unlimited* or some other flight sim well, do yourself a favor and get a set. Thrustmaster makes an excellent set. CH Products also makes a set. Using a second joystick for rudder control can be done, but the keyboard is definitely at the bottom of the list. It just makes your job much more tedious and difficult than it needs to be.

Rudder Workout

The next big stumbling block sim'ers need to get over has to do with the actual amount of physical movement rudder pedals require. Of course some pedals require more than others, but all of us can't help but feel self-conscience when we first realize how much rudder throw there is. The proper use of a rudder requires quite a bit of body language that many have never encountered before—never mind doing it in front of a computer. Real-life aerobatics flying requires quite a bit of physical movement.

Take the example of the Formula One race car driver. If you watched the race from a spectator point of view, what you'd see are the cars driving around the track with relative ease. The drivers make racing seem so smooth and easy, that one may think it would be a pleasant experience. In reality, the driver is in a cramped, hot, dirty environment getting his bones rattled. The spectator usually never sees the pedal dance that goes on inside a Formula One cockpit. This is pretty much what goes on with aerobatics flying. Don't worry what you look like to the guy in the next cubical or to your significant other. Just move the pedals as much as you need to.

WHICH WAY IS UP?

Anyone who's fooled around with an airplane rudder knows that it mainly controls yaw; although, rudder-only turns are possible. You press the same pedal as the direction you want the nose to turn toward. To move the nose to the right, you press the right pedal and vice versa.

This is straightforward and simple when you're upright and level. Just what happens when you're on the side or inverted tends to confuse people. When you're flying knife-edge (wings perpendicular to the ground), your rudder is now in the same position that your elevator used to be in. This means applying top rudder (top in relation to the ground); your airplane will respond as if you were applying up elevator from an upright and level position.

This is pretty intuitive. What happens when you're inverted is another story. Let's look at a slow roll to the left. Most aerobatics planes feature symmetrical or semi-symmetrical airfoils. This is so the aircraft will fly pretty much the same upside down as it will right side up. With airfoils of this type, since either side of the airfoil will produce the same lift, the only way to keep the wing flying (counteract gravity) is to increase its angle of attack. This is why you need to keep your nose above the horizon, or you will lose altitude.

You begin the roll to the left by applying left aileron. As you start to roll, to keep the nose above the horizon, you need to apply top (right) rudder as it now acts like the elevator. Once inverted, your elevator works like an elevator again (only opposite—down is up and up is down) and your rudder returns to working like a rudder again, so none is needed. The transition from inverted to upright again requires top rudder to keep the nose above the horizon. The problem is that even though the roll is still to the left using left aileron, right rudder is no longer top rudder, left rudder is because the designation top is based on its relation to the ground. Think about it, and it'll make sense.

HOW MUCH RUDDER?

Now that you know which rudder pedal to push, the question becomes how much rudder do you need to use? Well, not to sound like a wise guy, but the answer is as much as you need to obtain the desired results. It's really a question that no one can really answer, however here are some guidelines. The amount of rudder you need depends on three things; how far you want to move the nose, your airspeed, and your power setting (see Figure 5.3).

Naturally, the more you move the rudder, the greater effect it will have. In other words, the more rudder you apply, the more the nose will move. However, the faster your airspeed, the more effective and sensitive it will be. Inversely, the slower your airspeed, the more ineffective and softer it will become. If you want to move the nose of your airplane say 3 degrees to the right, at a high airspeed, it may only take a

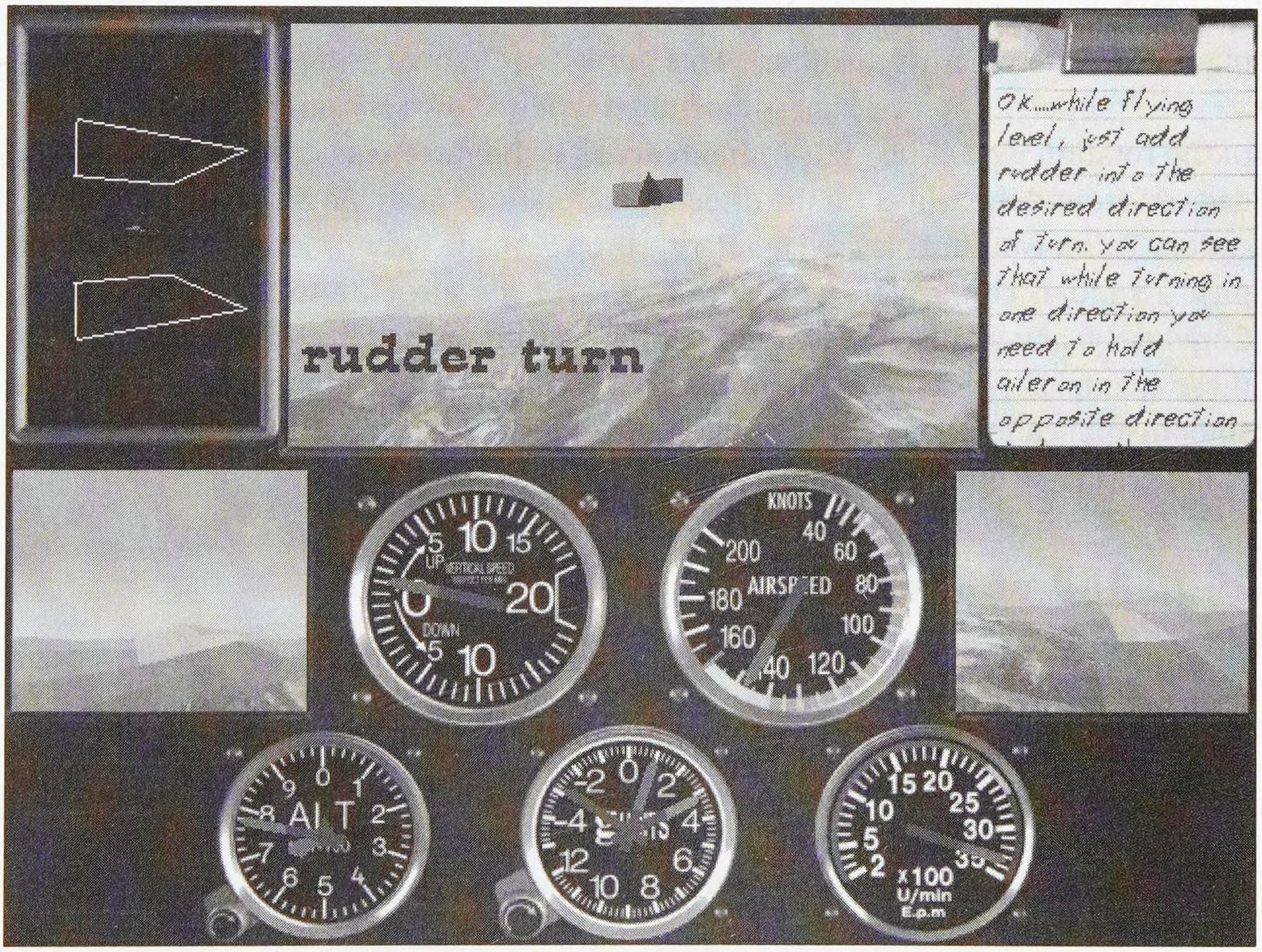


FIGURE 5.3: How far you turn your nose, airspeed, and power setting dictates the amount of rudder.

one-quarter right rudder. At a slow airspeed, it may take full right rudder to achieve the same results.

OTHER RUDDER USES

The third variable is your power setting in relation to your airspeed. There are four possible situations that need to be dealt with. High power and high airspeed, high power and low airspeed, low power and high airspeed, and low power and low airspeed. In each of these situations you must deal with torque effects and gyroscopic procession. While gyroscopic procession along with P-factor (propeller disk asymmetric loading) and propwash are considered responsible for torque effect, it is listed separately because it causes other problems.

A spinning prop has the same properties of a gyroscope. The gyroscope resists any effort to tilt its axis (or plane of rotation). If you think of a gyro as a toy top, if you tried to push it over while it is spinning on the floor, it would instead move parallel to the plane of rotation (across the floor). This property is known as *rigidity in space*.

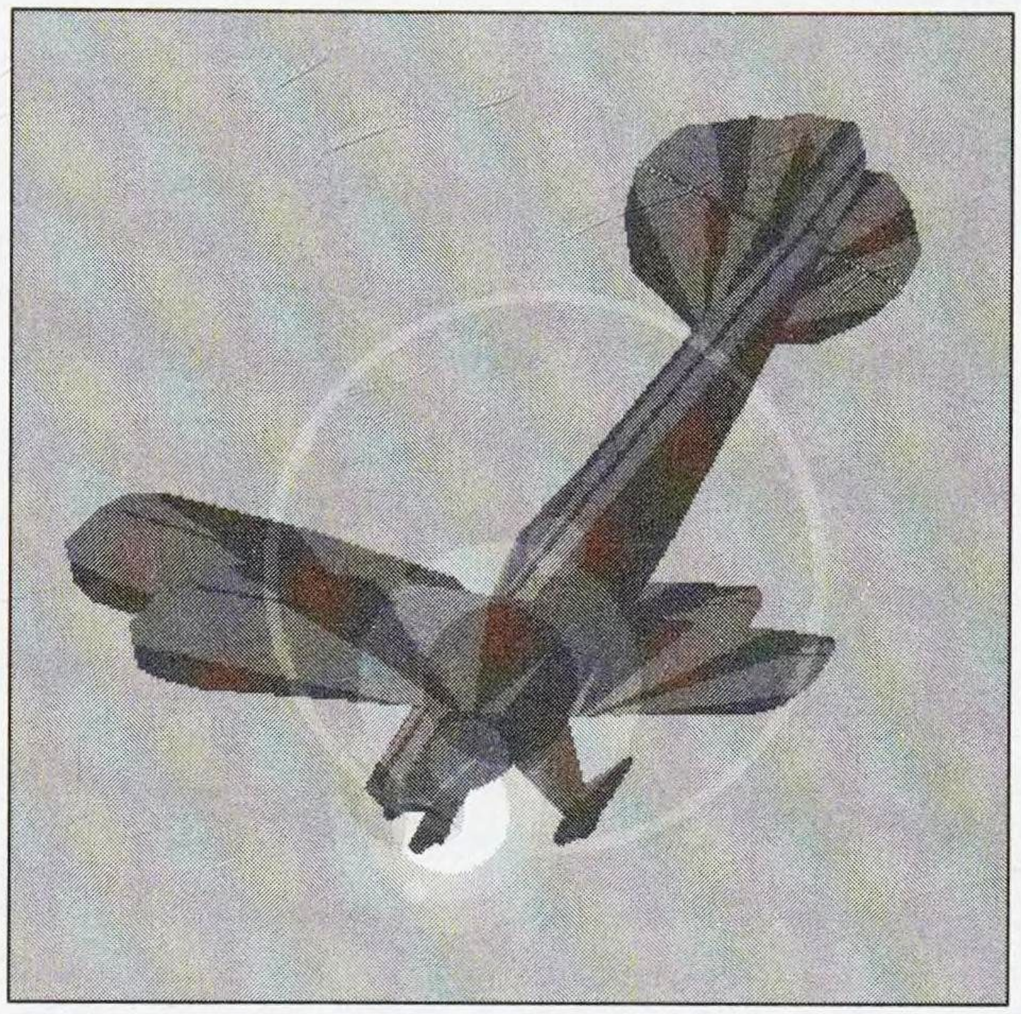
The property of procession is illustrated when a force is exerted against the side of the rotation gyro. The gyro would react as if the force was exerted at a point 90 degrees around the wheel (in the direction of rotation) from the actual place of application. This means in a clockwise-rotating prop airplane (when viewed from the cockpit), a sudden climb would cause the nose of the airplane to turn to the right. Conversely, any sudden dive would produce a turn to the left. Note that in both of these examples sudden control inputs produced gyroscopic procession effects. The smooth application of control inputs usually hides gyroscopic procession effects due to the greater torque effects that prevail.

TORQUE AND PROPWASH

Torque effects are most noticeable when you transition from low to high power and from high to low power. The more abrupt the transition, the more noticeable will be these effects. When you factor in airspeed, a transition to high power at a low airspeed and to low power at a high airspeed require the most rudder correction, but this depends on the design of the airplane. A clockwise-turning (from the cockpit) propeller causes a rotating mass of air to be accelerated toward the tail of the airplane. This air mass, called a *slipstream* or *propwash*, strikes the left side of the vertical fin and rudder and causes the airplane to yaw to the left. Some manufacturers use an offset

fin to counteract this reaction. This offset fin setting is usually for maximum effectiveness at the rated cruising speed. This explains why an airplane will fly straight on full power and veer off to the right if you abruptly remove power.

All of the engines in *Flight Unlimited* rotate clockwise (from the cockpit) except for the Sukhoi, which rotates counterclockwise.



6

Flight Simulator 5.1

Of the many challenges to be found in aviation, precise instrument flying is one of the most difficult. When mastered, it is also one of the most rewarding. It is very gratifying to climb up into a 200-foot overcast, fly for four hours without any visual reference other than the cockpit instruments, and then pop out of a driving rainstorm to see the runway of an airport on the opposite side of the country before you.

ALMOST LIKE THE REAL THING

A flight simulator duplicates actual flying as closely as possible without leaving the ground. *Flight Simulator 5.1* is not a simulator; it lacks a true cockpit environment and does not exactly and precisely duplicate the performance of the chosen aircraft. It is an oversimplified simulator, generally called a simulation. It can familiarize you with what's required to earn your private pilot's license and save you money in the process.

Students in the common Cessna and Piper trainers sit in the left seat during training. Position a stick or yoke for left-handed operation and a throttle for your right hand; that's the normal configuration. Put the keyboard between them. Even if you have the new programmable flight controllers, don't overly automate. You are going to have to reach around the cockpit in the real aircraft, so use the keyboard as the substitute for cockpit switches. Do automate viewing controls as much as possible. Rudder pedals go on the floor, obviously.

The manual includes two chapters on flight training, Chapters 12 and 13. It's set up for practice in the Cessna 182. The 182 is bigger than most trainers, but its performance is closer to training aircraft than *Flight Simulator's* other choices. Read the lesson outline in the book, and let the flight instructor demo the lesson. Go to the SIM menu and turn off Auto Coordination. This will make you move both the rudders and ailerons in unison to achieve smooth flight. Allowing the sim to do it automatically really doesn't prepare you for what's going to happen in the aircraft.

REALLY BASIC TRAINING

Lesson 1 in the manual deals with taxiing. The most basic of skills, the ability to taxi properly says a lot about what sort of pilot you are. Your flight examiner will be looking for a brake check after you begin moving; just tap them lightly to prove they work. Taxi at a quick walking pace and control speed with minimal use of brakes. Plan ahead while using the throttle; you don't want to start the takeoff roll with hot brakes. Stop near the hold line before the runway with the nose pointed into the wind for your run-up check.

The next lesson is attitude flying. Just make the aircraft go where you wish by using the controls smoothly, looking outside and referencing the instruments. The lesson includes a takeoff, box pattern, and landing. Use it to become familiar with the feel of *Flight Simulator* and get very familiar with looking around outside the aircraft. In the real world, keeping your head on a swivel is called clearing. Instructors like to see you looking around outside for traffic as much as possible. Start the habit here.

THE FAMOUS "10, 10, & 100"

You'll hear this phrase a lot! Straight and level flight is Lesson 3. Practice holding your altitude solely by reference to the outside horizon and the glare shield. Use quick looks at the instruments to confirm what you are seeing. Utilize ground references to maintain

heading; pick a landmark down your desired course and keep it in the middle of the windscreen. Adjust power to maintain airspeed and cross-check it continually on the gauge.

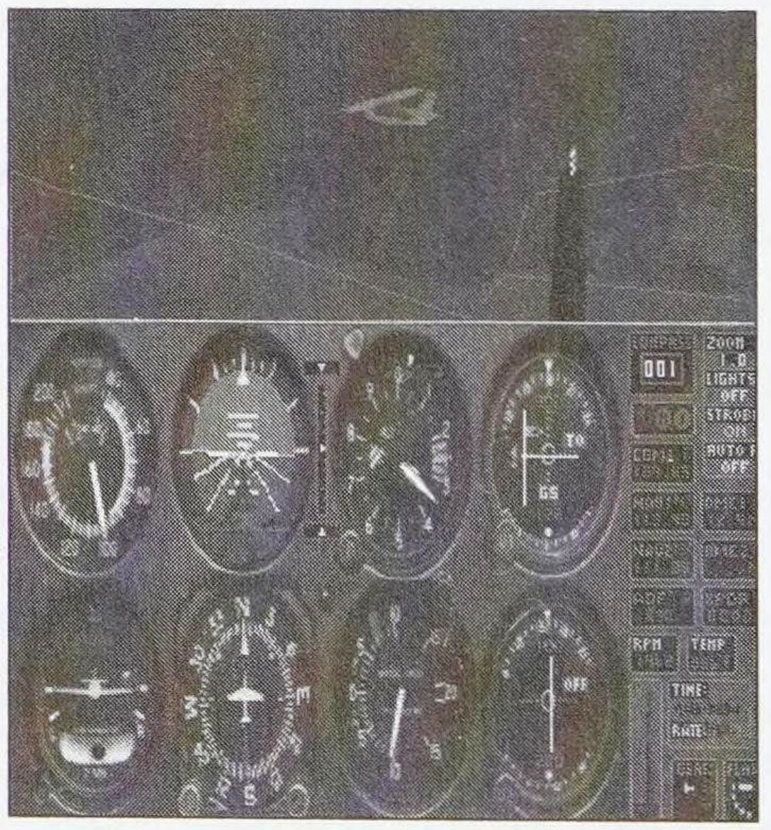
Trimming

This is the place to learn one of the most important aspects of flight: trim. Use the 1 and 7 keys on the keypad to trim nose up and nose down respectively. Every time you change the power setting, start a climb, or begin a descent, you need to adjust trim. If you're not busy . . . trim! It can't be overemphasized. You will also be expected to fly straight and level for at least 3 minutes solely by reference to the instruments. When you can maintain heading at ±10 degrees, airspeed at ±10 knots, and altitude at ±100 feet using either the instruments or outside references, you are ready to move on.

Turning

Turns will be another part of your check; lesson 4 will introduce them. You should be able to fly a standard rate turn with deviations of ±10 knots, rolling out ±10 degrees of desired heading and holding altitude at ±100 feet. A standard rate turn completes a 360 degree turn in 2 minutes (see Figure 6.1). The turn coordinator in the lower-left corner of the panel will keep you at the correct bank. With the wing aligned with the L or R index you are in a 2-minute turn. If the ball moves outside the middle reference, "step on the ball." That is, if it moves to the right, add right rudder.

Proper turns require the use of all three flight controls. Lead the turn with a bit of rudder, then roll into the desired bank. As you pass 15 degrees of bank, you will have to add a little back elevator to maintain altitude.



Lead your rollout by half your bank angle in degrees and again start with a little rudder. Remember to ease the stick forward as the bank decreases through 15 degrees. Power should not change much during the turn; set the throttle a bit above cruise and make small adjustments.

The manual's Lesson 5 deals with climbs. You'll be evaluated on straight, constant speed climbs. In the actual aircraft, your instructor will brief a target airspeed and the approximate pitch it takes to hold it at full power. Here, use about 12 degrees and 80 knots. Raise the nose to your desired pitch and add full power smoothly. Make small pitch adjustments to hold airspeed. The 10 percent of rate rule will give you a smooth level off. If

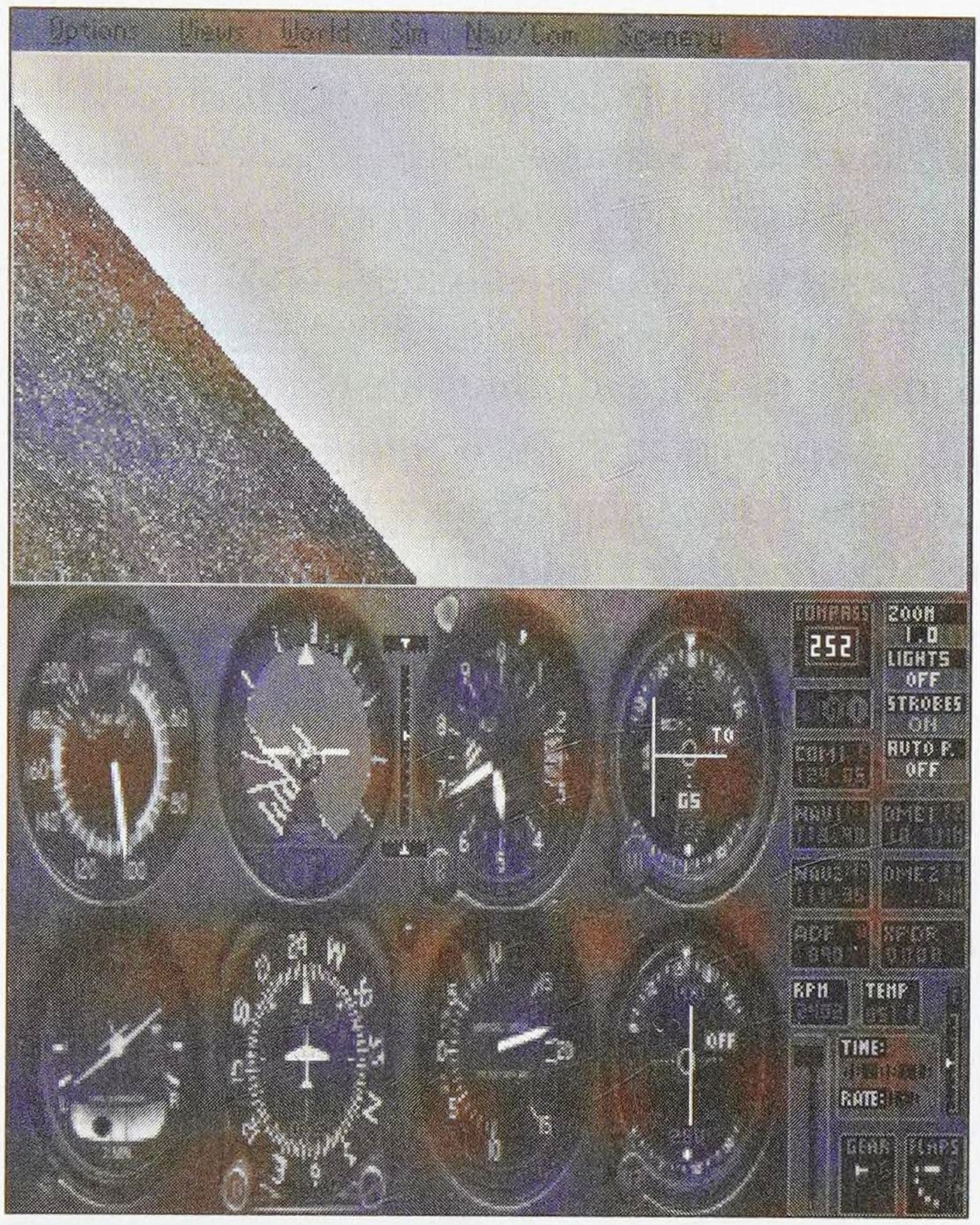


FIGURE 6.1: In a standard turn, note the left wingtip on the index in the Turn Coordinator on the lower-left corner of the panel.

you're climbing at 1,000 FPM, start to lower the nose about 100 feet below your desired altitude. Ease the power back after you reach cruise airspeed. Once again, ±10 knots, ±10 degrees of desired heading, and ±100 feet are the tolerances. Smooth, coordinated (keeping the ball centered in the T/C) control inputs are a key factor in passing the test.

Decants

Lessons 6 and 7 present descents, both constant rate (cruise) and constant speed (slow). The ability to perform a constant speed descent solely referencing instruments is evaluated using the now familiar "10, 10, and 100" standard. While practicing in *Flight Simulator*, set the power around 1,000 RPM, and hold altitude until you approach 70 knots. Then smoothly lower the nose to hold 70, varying pitch as required to maintain it. Don't let the heading wander. Lead the level-off by 10 percent of the rate of descent, and

gently add power as you bring the nose up smoothly. Always determine if your intended level-off altitude is safe before you begin the descent; if you trim trees, you bust the ride!

Traffic

Traffic pattern operations are covered in Lessons 8, 9, and 10. They are a major part of your flight training as well. Key factors for the normal takeoff are numerous. You'll be expected to set the flaps correctly, so use one notch in *Flight Simulator* to get in the habit. Line up on the centerline; it's no harder than being off a few feet. Add power to full throttle, compensating for torque by adding right rudder. *Flight Simulator* doesn't model enough torque; expect more in the airplane.

Get in the habit of making a quick check of the engine gauges on takeoff roll, and stay on the centerline. Ease the stick back at rotation speed (50 knots) and hold 70 ± 5 knots in the climb. When you have a positive rate of climb and there is no longer enough runway to touchdown and stop safely, retract the gear. At a safe altitude and climbing, retract your flaps. Maintain a straight track over the extended runway centerline until a turn is required. Use the rear view to stay aligned; it'll remind you to look back in the Piper. Keep takeoff power until reaching pattern altitude, normally 1,000 feet above the ground. You'll have to hold altitude ±100 feet and pattern speed ±10 knots.

Crosswind takeoffs are not much tougher. Add max aileron into the wind as you begin takeoff roll. As airspeed increases, aileron becomes increasingly effective, so you will have to take some out—slowly. Maintain the centerline with rudder. As you lift off, your nose will be straight and the wing into the wind will be slightly low. After raising the gear and flaps, crab into the wind and level the wings to maintain a straight ground track.

The proper straight-in landing starts with maintaining the correct ground track on final approach. Line up on centerline, adjust for wind, and stay there (see Figure 6.2). You're required to maintain the proper approach speed within ± 5 knots, so configure

the aircraft with gear and full flaps early on final approach. Then set your descent rate around 700 FPM, and use power to hold the speed. Use the runway numbers as your aiming point. Keep them centered in the windscreen. When you close with the runway, the numbers disappear under the nose. This is the time to raise the nose gently and flare. Hold the nose attitude as airspeed bleeds off and you'll touch down perfectly. If the numbers are your aim point, you must land within 500 feet of them, aligned with the runway.

How will you know when you've practiced these basic maneuvers enough? When you know what the instructor is going to say before it appears on the screen and when the critique graphs show only smooth lines, you're ready to move on to the advanced training. Remember, the tolerances are maximum tolerances. Don't exceed them. You can build habit patterns here that will save you big bucks out on the flight line.

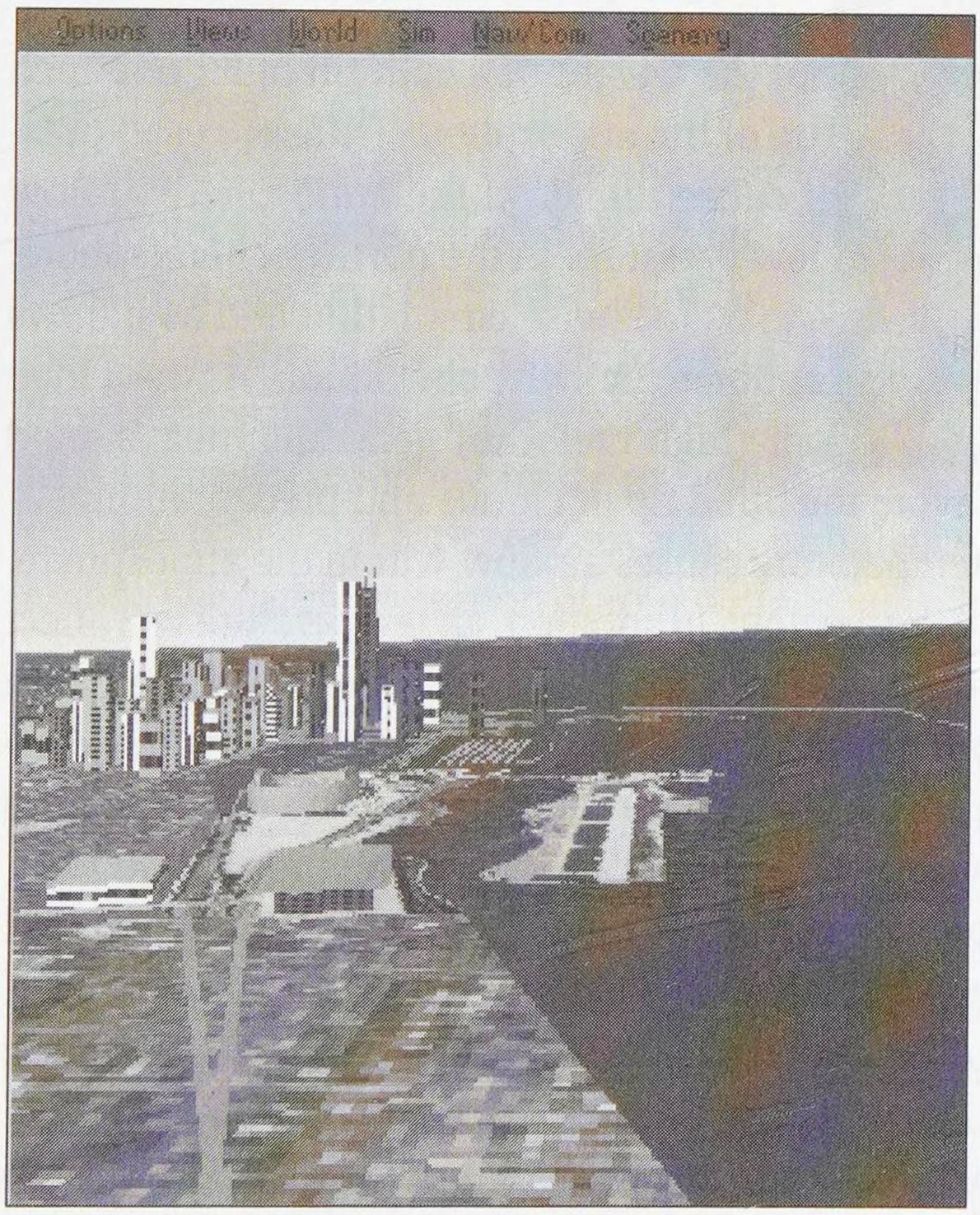


FIGURE 6.2: Line up on centerline early and stay there by crabbing into the wind.

WEATHER VARIABLES

A detailed explanation of weather, and how and why it occurs, is beyond the scope of this chapter. Entire volumes have been written on this complex subject and are available from various aviation catalogs or at the local library. The supporting material in the *Flight Simulator 5.1* handbook is brief and can use a little more explanation, however.

Because of uneven heating of the Earth's atmosphere, air temperature varies from place to place. These changes in temperature cause changes in air density that in turn result in changes in barometric pressure. The pressure changes cause motion in the atmosphere in the vertical (currents) and horizontal (winds). If you add moisture to this motion, the result is what we call *weather.*

The program will allow you to modify barometric pressure, temperature layers, wind, cloud formations, and visibility.

Barometric pressure is a measurement of the weight of a column of air one-inch square that stretches from sea level to the top of the atmosphere. Differences in pressure from one atmospheric area to another cause the air in the atmosphere to flow from an area of high pressure to an area of low pressure. In the northern hemisphere, air descends from the area of high pressure in a clockwise circulation and as it flows into the area of low pressure, it reverses to a counterclockwise circulation. As the added air enters the low, it ascends. Descending air (high pressure) generally means good weather, rising air (low pressure) favors the build up of clouds and precipitation.

As we've seen, variation in air temperature causes air flow within the atmosphere, affecting the barometric pressure and the weather. In addition, air temperature will affect your aircraft's performance by altering the density altitude. Simply put, density altitude is pressure altitude corrected for nonstandard temperature variations. Here's an example of how important it is: At an airport 2,545 feet above sea level, with a temperature of 70 degrees and a barometric pressure of 29.70 inches, the density altitude is 4,000 feet. Your aircraft will perform on takeoff as if it were at a much higher altitude than that shown on the altimeter. Even in a jet aircraft like the Lear found in *Flight Simulator 5.1*, the decrease in performance can be dramatic. Try a takeoff in Champaign at 101 degrees; you'll see the difference!

Winds are the horizontal flows of air produced by temperature and pressure changes in the atmosphere. They affect the pilot throughout his or her flight, form takeoff to touchdown. Winds can be your friend; a strong tailwind can save you time and fuel en route to your destination. They can be your enemy as well; a severe

windshear on takeoff or landing can end your career as a pilot permanently. *Flight Simulator 5.1* allows you to simulate both the favorable and unfavorable winds.

In the simulation the surface winds are magnetic; their direction is the same as that shown on your aircraft compass. Winds aloft have direction relative to true north, which is different from that shown on your compass. The variation for a specific location can be found on an aviation chart by reading the numbers on the isogonic lines, lines that connect points of equal magnetic variation. Add west variation and subtract east variation to get a compass heading equal to a true heading. It is a detailed touch in the simulation, but it won't really affect your flying if you pay attention to the instruments.

Flight Simulator 5.1 gives the user the ability to create detailed sky conditions. You can have up to two cloud layers and one thunderstorm layer in any of three different weather areas. Many different types of cloud are modeled, with variable bases and tops, sky coverage, turbulence, and icing capabilities at your command. The careful selection of your options will allow a realistic workout on the gauges.

Setting Up a Weather Demo

Now let's take a look at the depth of the weather programming in this simulation. We'll takeoff from Champaign and fly up to Chicago's Meigs field. We'll start with a density altitude problem and windshear on takeoff, penetrate a line of thunderstorms, and descend through an overcast to an ILS approach and landing.

Select the Options menu, Aircraft category, and select the Lear of this flight. Now move to the World menu, Airport category, Chicago area. Highlight Champaign/Willard, Runway 32L airport for your departure point. Go back to the World menu, pick Weather, and add a Weather Area named "Willard."

Setting the coordinates of your weather area is the most difficult part of this operation. Getting your weather just where you want it takes a little trial and error. Microsoft

could speed up this process immensely by allowing you to outline the desired area on a map. For this sortie, use N40/W88 for one boundary and N42/W87 for the other. Make it 50 miles wide with a 5 mile transition. Set its course at 110 and the speed at 2. These settings will give us a slow moving weather area just north of Willard. Hit the OK button and you'll be back to the Weather menu.

Select Clouds and select the Create button. We're allowed two cloud layers plus one cumulonimbus (thunderstorm) layer. Set up your layers like those shown in Table 6.1.

TABLE 6.1: WEATHER LAYERS

LAYER	STRATUS	CUMULUS	CUMULONIMBUS
Base	2,000	4,000	8,000
Tops	3,500	8,000	15,000
Cover	4/8ths	Overcast	Dense
Deviation	66	500	500
Turbulence	1.5	2	8
Ice	On	On	On

This will give you an initially VFR departure, transitioning to instruments and breaking out on top into an area of thunderstorms. With that turbulence, you need to give the storms a wide berth!

Now select Winds and create the settings in Table 6.2. Once again, we can have three wind layers.

TABLE 6.2: WIND LAYERS

LAYER	STRATUS	CUMULUS	CUMULONIMBUS
Location	Surface	Aloft	Aloft
Type	Steady	Steady	Steady
Base	Depth 49	50	2,500
Top		2,500	1,000
Speed	22	55	23
Direction	320	140	110
Turbulence	3	5	2

With these winds, you will experience a noticeable windshear at 60 feet AGL on takeoff. The high altitude winds will give you a little drift problem as you head north.

These winds are blowing toward the low pressure area we will set up later, simulating the flow of air from high pressure to low pressure.

We'll quickly set four temperature layers that will allow you to experience a high density altitude problem. Select the Temperature button and create the layers shown in Table 6.3.

TABLE 6.3: TEMPERATURE LAYERS

	LAYER 1	LAYER 2	LAYER 3	LAYER 4
Altitude	0	1,500	5,000	15,000
Temperature	100	95	0	50

The high surface temperature will give you a density altitude of a little more than 3,000 feet; you will notice a difference in takeoff performance. We've set the 5,000 foot temperature a little unrealistically low, but this will enable icing in the clouds. Leave the Day/Nite option off, with the range at zero.

Barometric pressure can be quickly set at 30.00 to represent the area of higher pressure that is moving southeast out of our area. Don't use the drift feature. Visibility should be set to 4 miles—adequate for our VFR takeoff but low enough to quickly have us on the gauges.

For en route weather, we'll modify the Global weather settings shown in Table 6.4. Start by selecting the Cloud button. Use these settings to give a solid undercast and a few thunderbumpers to dodge. Add some wind to give yourself a little trouble following the radial (see Table 6.5).

TABLE 6.4: GLOBAL WEATHER SETTINGS

LAYER	STRATUS	CUMULUS	CUMULONIMBUS
Base	4,920	8,000	15,744
Tops	6,888	113,500	15,760
Cover	Overcast	Dense	7/8ths
Deviation	0	499	0
Turbulence	1.5	8	1.5
Ice	On	On	On

TABLE 6.5 WIND LAYERS

LAYER	STRATUS	CUMULUS	CUMULONIMBUS
Location	Aloft	Aloft	Aloft
Type	Steady	Steady	Steady
Base	1,500	13,000	22,000
Top	1,200	21,000	33,500
Speed	35	34	43
Direction	120	145	155
Turbulence	3	1	1

These settings will also give you a little tailwind on the way and shorten the time to Chicago. Temperatures won't be much of a factor on the en route portion of the flight.

We'll set the barometric pressure to 29.80, simulating the drop in pressure as we approach the low. We'll keep the visibility at four miles to keep the focus on instrument procedures.

Lastly, using the World menu and the Weather choice, we'll create another area of truly nasty weather called *O'Hare*. The boundaries are N42/W88 and N41/W89, setting 50 miles for width with a 5 mile transition. We'll make it basically stationary by setting a course of 135 at a speed of 1. Click OK to return to the Weather menu.

By now you are familiar with the cloud setup procedure, so enter the layers shown in Table 6.6.

TABLE 6.6 TROUBLESOME CLOUD LAYERS

LAYER	STRATUS	CUMULUS	CUMULONIMBUS
Base	850	2,500	8,000
Tops	2,499	8,000	15,000
Cover	Overcast	6/8ths	Scattered
Deviation	66	246	499
Turbulence	2	2	8
Ice	On	On	On

These settings will require some dodging of thunderstorms, an instrument let down, and an ILS approach to O'Hare.

We'll set up our winds to continue our tailwind but to favor an ILS to runway 14R at the field. Enter the winds from Table 6.7.

TABLE 6.7: TROUBLESOME WIND LAYERS

LAYER	STRATUS	CUMULUS	CUMULONIMBUS
Location	Surface	Aloft	Aloft
Type	Steady	Steady	Steady
Base	Depth 2,500	2,800	6,500
Top		5,500	15,000
Speed	12	23	24
Direction	120	160	99
Turbulence	1.5	2	2

Temperatures will remain warm, as Chicago has all summer! Once again we'll set an artificially low temperature, this time at 5,000 feet. Remember that a load of ice will seriously degrade your aircraft's performance. Get down to those warmer temperatures quickly.

We'll represent our low pressure area with a barometric setting of 28.00 and lower the visibility to 3/4 of a mile. You'll have to thread the needle on this ILS if you expect to see the lights when you break out.

INTO THE GOO!

Before you take off, remember to save this situation! It takes awhile to set up and you may want to use it again. From the Options menu, choose Save Situation. Type in a title and a description if you wish, and then enter a file name. Make sure you then choose the Options button and specify the options you wish to save; just check them all. Then press OK. Remember you can modify this situation indefinitely after you select it. It will still be available as the last version you saved. Now you can simply choose Situations from the Option menu, select your newly saved weather experience, and go fly!

You're in for a bit of work here. Takeoff, climb out direct to Roberts VOR, switch to O'Hare VOR and cruise on up at 13,000 feet. Reaching the VOR, descend outbound at O'Hare on the 350 radial to be at 5,000 feet about 20 miles out. Turn left back inbound, intercepting the I40 radial and transition to the ILS at about15 miles. Make a good approach and landing, and congratulate yourself.

If you do this right, you will have experienced the performance problems of high density altitude and windshear. You will have made an instrument climb out and broken out on top only to find thunderstorms in your path. Do it all correctly and you've got a flight you can remember with pride.

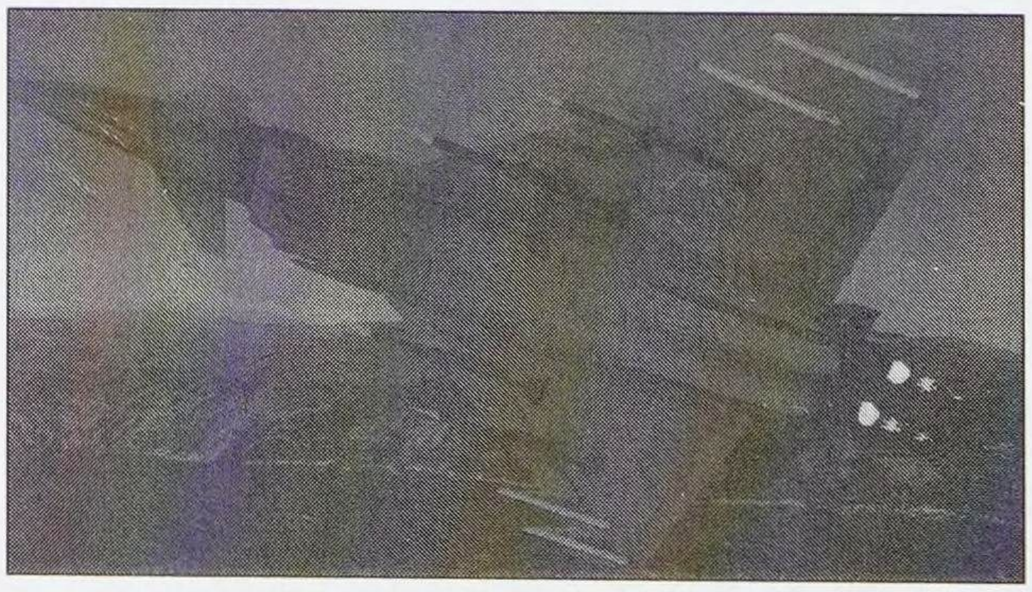
7

Eurofighter 2000

Ocean Software's flight simulation, *Eurofighter 2000*, closely models the actual aircraft and weaponry that are still in development. Digital Image Design, Ltd., the company that developed the game, has also done Eurofighter simulator programming for the training of RAF pilots. While much of the aircraft and weapons performance data is highly classified, you can be certain that DID knew what they were doing when they programmed the characteristics and effectiveness of the weapons in *Eurofighter 2000*. Every individual weapon received its own flight model. The effects of aspect angle, speed, and altitude will partially determine the effectiveness of your shot.

USING AIR-TO-AIR WEAPONS

With that in mind, here's the scoop on how to use your air-to-air weapons in the game. After you have a handle on the weapons, then we'll discuss the game's mud-moving equipment.



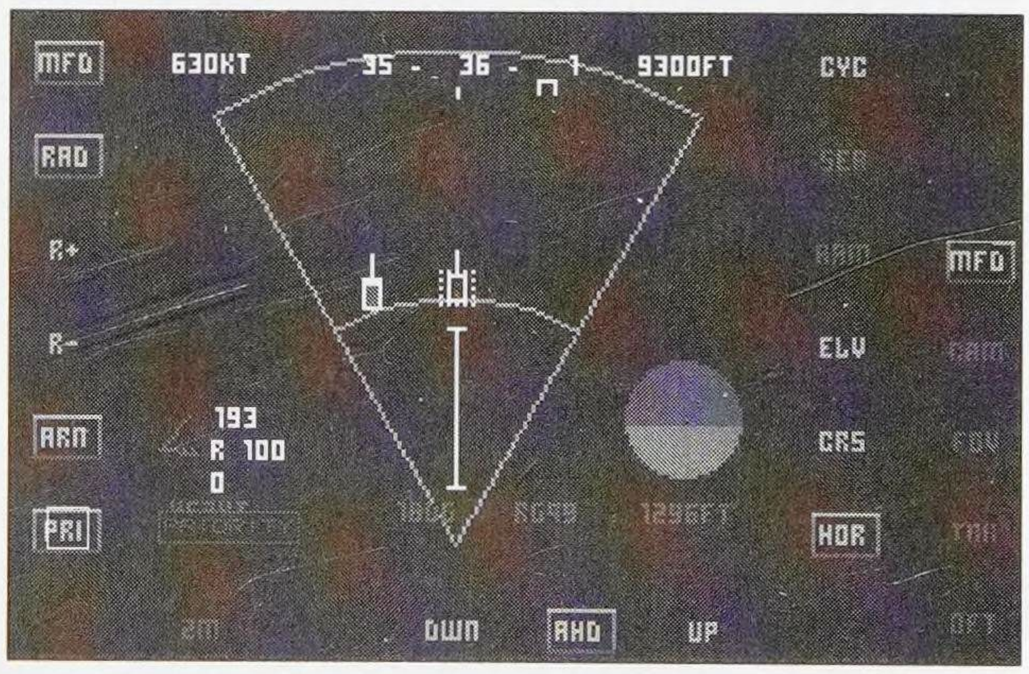
DEATH FROM A DISTANCE

Rule number one in using any missile is to get the target centered in the missile aiming circle on the HUD. This will not always be possible, but it is the ideal. Pay close attention to the caret, or arrowhead, attached to the target box. When the caret is above the box, the target is moving toward you; this gives your missile longer range because the bandit is coming to it. The caret below the box indicates a target moving away. The missile's range is shorter because it has to chase the target.

The white vertical bar on the left side of the HUD is your missile's range bar. The caret on the side shows where you are in the missile's envelope. At maximum range, with the caret at the top of the line, you'll hear the shoot cue. When you first hear or see the shoot cue, it only means you have a *chance* of hitting the target. It does not mean you have the optimum shot. The best time to shoot is about one-third to halfway down the range bar. You can be too close; at the bottom of the range bar the missile has little time to track and maneuver. If the target maneuvers violently, you can lose the missile.

LONG-RANGE MISSILES

With your longer-range air-to-air missiles, the S-225 and AIM-120, your best shot occurs at high altitude, high speed, and when closing head to head with the target. Missile range falls off dramatically at lower altitudes because of increased drag. The faster you go, the faster your missile is already moving when it leaves the rail. It has a higher kinetic energy and thus, longer range. The head-on closure gives more range because the enemy is coming to the missile.



The S-225

The S-225 is a stealthy missile, intended for Beyond Visual Range combat. It is hard for your adversary to pick up on radar until it is quite close. The pulse motor gives it the longest range of all your missiles and makes it harder to pick up the smoke trail visually. Even so (despite the manufacturer's claims), a good pilot with good defensive aids

can do well against any long-range missile. Regard any kill you get with a single S-225 as a bonus. You can improve your chances by shooting two or three of them at one target. Pause a few seconds between shots. This tactic depends upon the size of the enemy force; it's not good to run out of missiles!

These missiles buy you time; while they force the bandits to ignore you temporarily, you can close to a better position for the kill. Perhaps the best use of this missile is to put escorting fighters on the defensive while you close with the bombers that are actually your mission objective. After engaging the fighters, use the radar to prioritize targets; press PRI on the radar MFD. This will make bombers the number one target. Shoot and beat feet!

The AIM-120

The AIM-120 is a medium-range missile also intended for BVR intercepts. Use them in pairs against fighters; the bandit has a good chance of spoofing one missile with defensive aids and tactics. Wait about 4 or 5 seconds after your first shot and hose him again. While the first missile is inbound, the bandit will be maneuvering to evade it while still trying to get in range to shoot back. He'll be bleeding energy as he makes tight turns to lose the first missile. The second missile should catch him in a less maneuverable state. Rumor has it that the RAF doctrine calls for shooting 4 missiles per bandit. Of course, they are playing for much higher stakes than computer simulation pilots!

This missile makes a great combination punch when used with the S-225. Shoot the S-225 at two-thirds range. Wait 5 seconds, make sure the AIM-120 is in range and drop one on the same bandit. You'll almost always get a kill. In the bomber intercept missions, shoot single S-225s at the fighters as previously discussed, prioritize your radar for bombers and shoot the 120s at mid range. You can use a single missile against a bomber with a good chance of success, because they don't maneuver as well as a fighter.

SHORT-RANGE MISSILES

The AIM-132 ASRAAM is a short-range dogfighting missile with thrust vectoring. As it comes off the rails, it makes a short, low-power burn, utilizing thrust vectoring to orient itself toward the target. Then the main motor cuts in and the missile goes for the target like a mad Rottweiler. Main motor ignition occurs whether the missile fully orients toward the target; therefore, this missile is still most effective when you are on the bandit's six.

The off-boresight feature enables pilots to take a shot even if they can't quite get the nose around enough, or just can't take any more G's. Best shooting range is again near the mid-point on the range bar. The off-boresight capability really drops off beyond 90 degrees at ranges inside of 3 miles. Even in this situation, you can use it defensively to save your life. If the bandit is getting around behind you and looks as if he's going to get a shot, use your helmet-mounted sight and shoot one at him. When he breaks to lose the missile, shoot another one. The second missile has a much better chance of hitting him. In any event, he'll be defensive instead of offensive. You might be able to turn the tables on him or get away (see Figure 7.1).

The AIM-9M Sidewinder modeled in the game is not an off-boresight missile. While advertised as an all-aspect missile, it is not that effective unless you maximize its strengths. You'll find the most successful technique is to have the target in the forward cone of your aircraft. Just keep the bandit centered in the HUD, wait for the lock tone, and you'll have a reasonable PK (Potential Kill) with this missile. If you can get on the bandit's six and lock him in the middle of the HUD at launch, it's close to a sure-thing kill. The enemy will use flares to spoof this infrared-guided killer. The Sidewinder may break lock before launch; if you lose the tone, just wait a bit. The missile will re-acquire

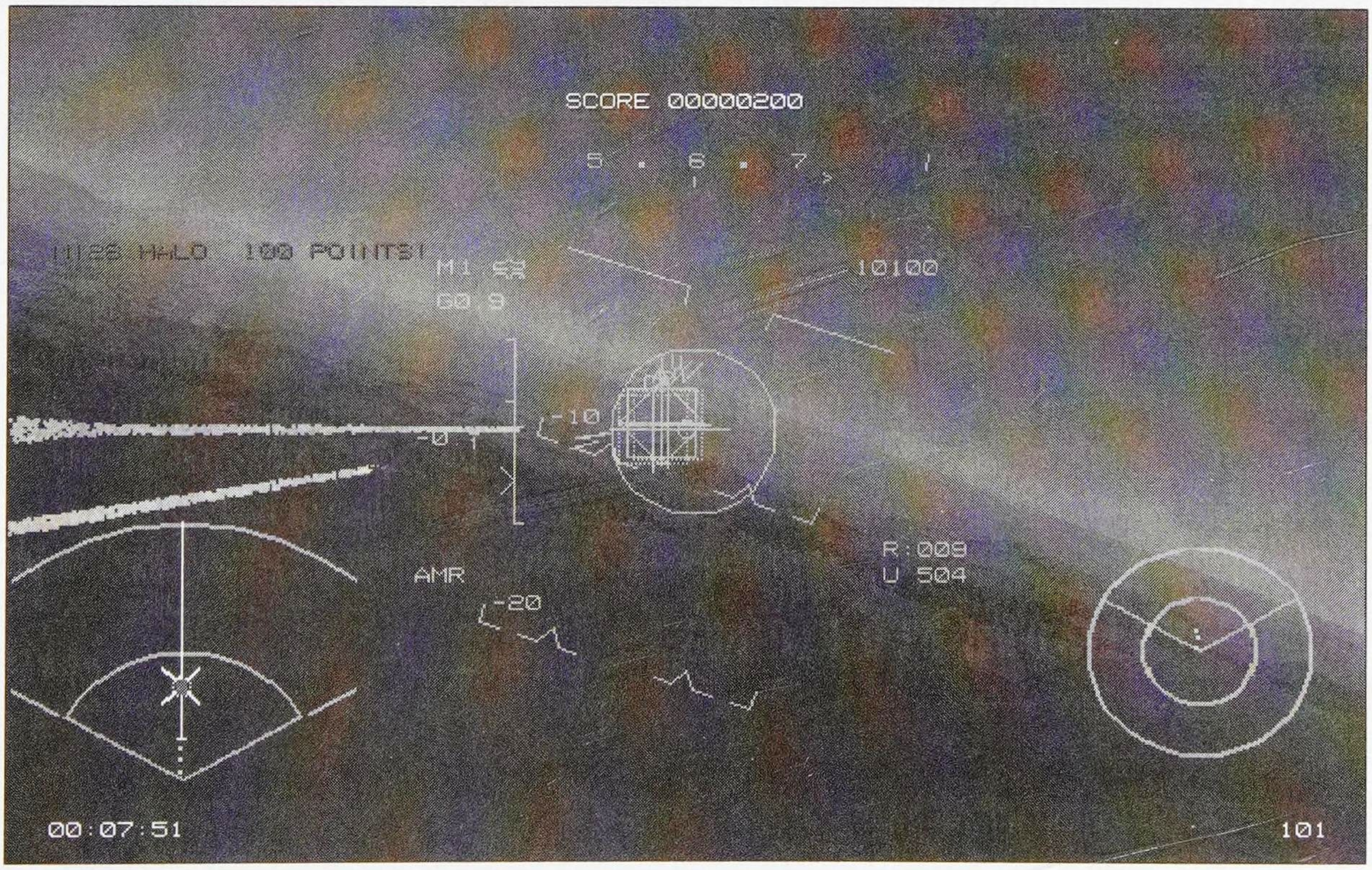


FIGURE 7.1: Use many missiles when you can to overpower targets.

if you keep the nose on the bandit. Once again, shooting pairs of missiles is a good technique—if you can afford it.

THE GUN IS YOUR LAST RESORT

This game bases its air-to-air combat around missile shots. If you run out of missiles, it would be foolish to go hunting for enemy fighters with the gun. Still, there will be times when it's all you have or the opportunity is just right. For example, the gun is great for mopping up bombers when the fighter escorts are no longer a factor. Your range is three miles at maximum, but it's really ineffective at that range; you're hoping for the "Golden BB." The best shooting is going to be inside of one mile. Get as close as you can.

The gun has an autofire capability that trips a short burst whenever the sight passes through the center of the target box. It's very difficult to get a good shot with the autofire feature of the cannon, unless you are coming up behind the target and then drifting the sight slowly up over the target. That technique gives you a good chance to pop him. Try it on the lumbering transports and bombers instead of wasting missiles needed for fighter opposition. Most of the time, though, you'll be working the guns manually.

In a turning fight, pull a bit of lead pursuit and get the velocity vector just in front of the bandit. Then ease off the pull just a bit, and let the sight drift across the target box and squeeze off a few bursts. The next best technique is to get into a steady lag pursuit and slowly tighten up the turn; fire as your sight passes through the target box. Once again, if you're trying to kill fighters with the gun, you've already made one mistake! Remember, the enemy has an AA-11 Archer missile with off-boresight capability very similar to your ASRAAM. When you're down to guns, it's time to go home.

EARTHMOVING EQUIPMENT

Now let's take a look at air-to-ground weaponry supplied in Ocean/DID's *Eurofighter 2000*. The emphasis here is on weapon selection, parameters for using weapons, and tips for their successful employment.

IRON BOMBS: AN INEXPENSIVE REAL BLAST!

While Smart Bombs are the rage, dumb old Iron Bombs do most of the general demolition work. They're cheap, effective, and pretty accurate if the delivery man does his job. They're great for taking out groups of the same class target, like parked aircraft or oil tanks. Selection of this weapon really depends upon the air defenses in the target area. For a heavily defended area, use a longer-range weapon to shorten your exposure time over the target. For best accuracy, use a high-angle attack; a low-angle attack reduces your chances of a shack.

The best profile is to ingress at high speed (550 +) and low altitude. About 4 miles from the target, pop up steeply, climbing to 9-10,000 feet above the target. Begin a Split S to get the target in the HUD, put the CCIP on the target, and roll upright. You should be coming down on a really steep angle, greater than 60 degrees. Press the dive to about 5,000 feet, and pickle. Exit away from threats, and then jink and dive into the weeds. Use terrain features to mask your egress.

It's dangerous; you're exposed during the pop up and dive. However, it's more accurate, so you may not have to come back. Low-level delivery will work against large targets like a big building. Come in at 500 knots, at tree top height; pull up slightly to put the pipper in the middle of the wall and drop. Break away from the blast area and again use terrain masking. You should take the building out while remaining hard to target.

WHAT IS THAT RUBY RED LIGHT?

Laser-guided bombs are the same old iron bombs with a guidance package. The game procedures are very close to the RAF's actual TIALD trainer, also done by DID. Some classified elements were changed. To hit with these bombs you still have to come quite close to the target. Range doesn't greatly increase over a normal iron bomb; the main improvement is precision. Use LGBs for lightly defended targets that are difficult to hit, like a bridge or a bunker located next to the nursery school. An altitude of 10,000–15,000 feet AGL for delivery is good. Keep the plane level; if you roll the aircraft the wing may mask the laser and it'll break lock.

The bomb has a generator on board that only powers the fins for one minute, so watch the countdown timer. Wait for the single pip to come between the two TIALD markers on the right side of the display; the best time to drop is when the pip is halfway down. You must keep lasering the target until the bomb impacts. After you drop, you can begin gentle evasive maneuvers, but keep the target in the crosshairs to maintain lock. Use the autopilot to fly the aircraft until you become used to the procedures.

SHOTGUN!

CRV 7s are a great ground attack weapon for thin-skinned targets. They are the weapon for choice for close air-support missions against small boats, tanks, trains, and small buildings. The CRVs use a laser range finder that is calibrated to 4 miles, the maximum range of the rocket. The standard cannon sight is simply recalibrated for rocket use. Let it wind around to about half of the scale or less for a good shot. Closer is better if the ground fire's not heavy. It's a predictor sight, so just drop it over the target's lower half and you should get a hit.

Ingress down in the weeds doing 550+. About 3–4 miles out, pop up to 4–5,000 feet, dive at the target putting the pipper just in front of it. Press in as close as you dare, and hold the trigger down for continuous fire. Ease the pipper up to the target, and hold it there until you blast past. Break hard, get back down on the lawn, and beat feet. You'll love these babies!

SMILE, YOU'RE ON TV!

The Maverick is best against moving vehicles; it'll track and kill. It's also good against soft, stationary targets like radar sites. Maximum range is about 10–12 miles. Unfortunately, you have to get in around 5 miles to clearly ID the target. Don't go dueling SAMs

with it! The Maverick modeled here is the IR type; it locks onto the center of a heat source. After lock on, the target will be displayed on the IRST screen beneath the HUD.

A burning tank is a large heat source, but there's no point in hitting it again. Check the IRST before pulling the trigger. The standard halfway down the range bar shot improves your chances of a hit. You can pan the aiming system so you don't have to approach a target head-on. A great tactic is to fly behind a ridge line parallel to the target area. Aim the missile seeker off to the side. Then pop up and try to acquire a target. When you get a lock, shoot and drop back down below the ridge. It'll drive them crazy!

DURANDAL, DESTROYER OF RUNWAYS!

The Durandal is specifically designed to take out runways. A low altitude weapon, it's best when dropped at about 500 feet. It deploys a parachute, then a rocket motor ignites driving the weapon into the concrete, detonating under the surface. Line up with the runway almost as if you were going to land; don't be quite straight down the runway. Plan to cross it at a shallow 5 to 10 degree angle about mid-field. Your approach speed should be about 550 knots.

Fly with wings level and be ready to release the Durandals as you cross the runway. It uses the same sight as the iron bombs, recalibrated for Durandal's parameters. Keep the bomb fall line running down the runway. When the CCIP is on the near edge of the concrete, drop one, pause, and drop another. Run for your life!

CLUs: THE RAIN OF DEATH

Cluster Bombs are area weapons. After a drop, 147 small bomblets spread out to take out dispersed, soft targets like personnel, artillery, and vehicles. Take a pair along on your close air-support missions. They must be dropped right at 500 feet for maximum effectiveness. If you drop higher, they scatter too widely, and if you're too low they won't give the necessary coverage.

Ideally, you plaster an area about 150 yards long and 100 yards wide. Speed should be about 500 knots; it also uses the same sight as the iron bombs. Use the bomb fall line to line up on your targets and pickle when the CCIP touches the nearest target. Drop the CLUs and then come back around with rockets to light up the survivors!

SOUND THE ALARM!

The Alarm missile is the fighter pilot's friend. It's hard to repress a chuckle when radar paints your Alarm armed EF. Make room for these when you're going into SAM territory on any mission.

Alarm has two modes: direct and indirect. Direct mode locks on any operating SAM radar within range and line of sight. Normally, this occurs during your attack run-in. You'll get a targeting box with a confirmation cross. Release the weapon and it should take out the radar. Going into a known SAM area, use JTIDS to confirm a radar's presence. Use low level ingress. As you approach the radar, launch at about 8 to 10 miles away in the indirect mode. The weapon will zoom climb to 40,000 feet and deploy a parachute. It will slowly descend, waiting for the radar to illuminate. After launch, turn parallel to the SAM site, ease up a bit, and get him to turn the radar on and lock you up. The missile will drop on him. Dive back down to break the lock and grin. It's got to be one of the best moments in the game!

ABANDON SHIP! ABANDON SHIP!

The Sea Eagle, like the Harpoon, is a great anti-ship weapon. Use it against ships or oil platforms. The radar will detect, select, and ID the targets by ship class. If the mission calls for striking a carrier, make sure you have a Kuznetsov locked! For release, keep speed a bit below Mach 1; the Sea Eagle uses a turbofan engine that compressor stalls at Mach speeds. Drop the weapon from 2,000 feet and at a range of 60 miles. It will drop down to a sea skimming profile and turn on its own radar in the final attack phase. Empty the rails, get down to wavetop level, and head for home.

DEFENSE! DEFENSE!

Ground Attack missions are not totally offensive. You must use good defensive techniques to get to the target. Terrain masking works in this game. Use it! Travel low in

fjords and hide behind ridges. Keep electronic emissions to a minimum. Keep ECM and radar off until you must use it. Utilize JTIDS information for navigation and threat avoidance. Now, go move some mud!

8

World Circuit Racing: Grand Prix II

While you cannot guarantee this chapter will make you world champion in MicroProse's *World Circuit Racing: Grand Prix II*, it *can* give you a good foundation to get started on your way to the Championship. The rest will be up to you. Before we get into car setup, let's go over some of the essentials.

GETTING AROUND THE COURSE

For years, we sim heads have had the words *frame rate* drilled into our brains. Understandably, any sim lacking a playable frame rate simply isn't playable or enjoyable. We'd give up some graphics detail (reluctantly) to trade for a couple of extra precious frames. However, while *Grand Prix II* qualifies as a CPU cycle sucker, with the quantity of graphics options available to you, you can usually reach a balance of performance that all but the most demanding can accept on most machinery. The first thing to be aware of is that the estimated frame rate numbers in the graphics detail level screen is just that—an estimate (which seems more accurate in the VGA mode than in SVGA).

While frame rate remains important, what seems to be more critical for good performance is CPU processor occupancy. Quite simply, if your occupancy number is too high, it doesn't matter what frame rate you've got it set to; you're not getting it anyway. Press the O key when driving and the processor occupancy percentage will appear. The highest occupancy number you're likely to see on any track usually comes at the starting grid, so check your numbers there.

Note that each track seems to have a different level of CPU demand. I believe Monaco is one of the most CPU demanding, so if you set your level there, you should be pretty well set up for any of the other tracks. By adjusting your frame rate and detail levels, you control the processor occupancy. Shoot for a number as close to 100 percent as possible (which in SVGA, will be a couple of frames below the estimate). While you can go over 100 percent, try not to allow the occupancy to go too high. A 120–130 percent level seems okay for the average set up, as you can see in Figure 8.1. Graphics hounds will probably find 17 frames is the playability limit. Anything less does

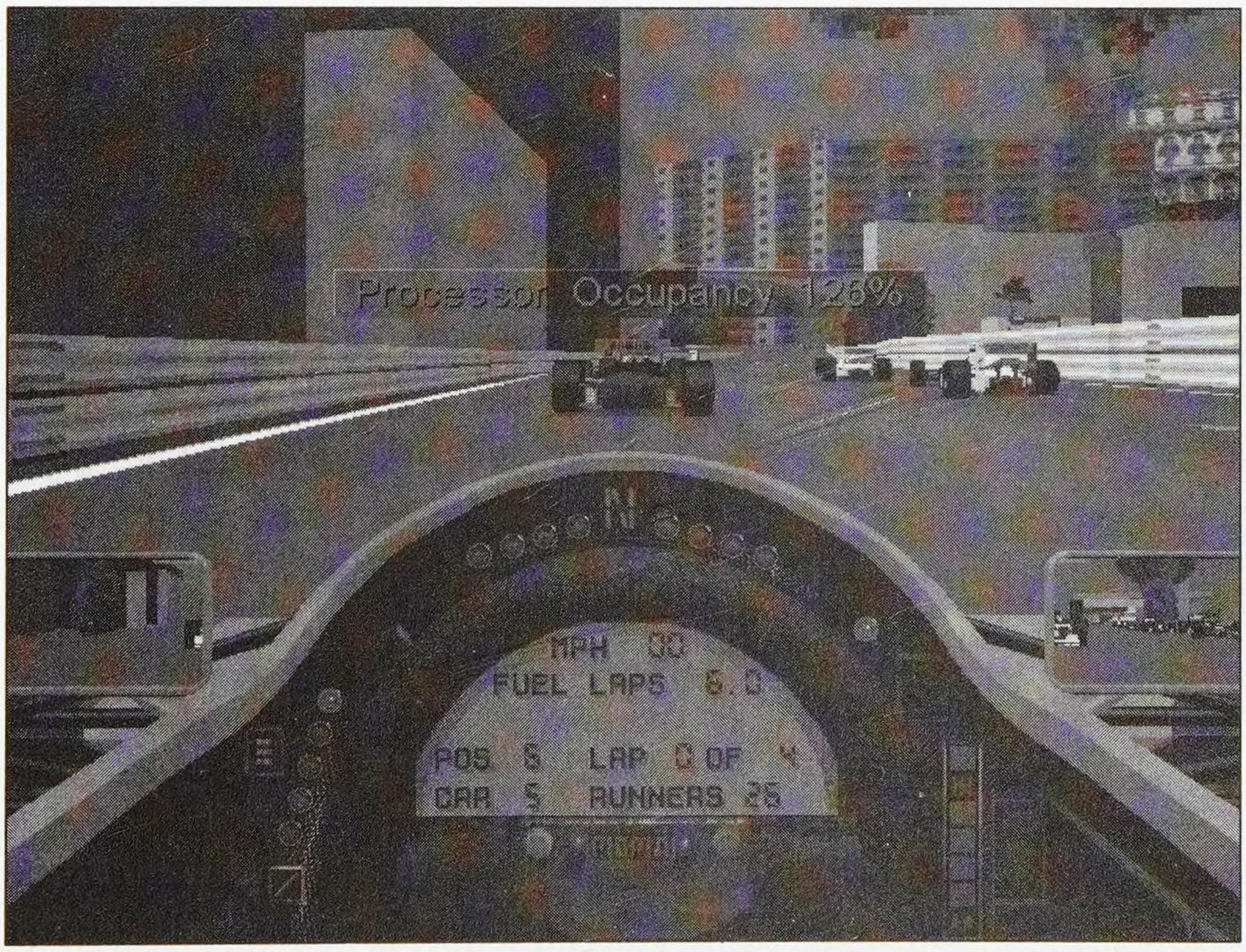


FIGURE 8.1: Control the processor occupancy by adjusting frame rate and detail levels.

not provide good feel for what your car is doing, and that's critical if you're going to drive fast.

TEXTURE LECTURE

Okay, so now you know how to get good frame performance; but which graphics details should you turn down? In the long run, it's all a matter of personal taste, but some simple tips here may help. First, you do have the option to use the automatic detail setting. However, the problem with that is that the SVGA estimated frame rate and processor occupancy don't match well, so ultimately, processor occupancy will often be too high, and frame rate will suffer.

However, don't despair. The manual process isn't too mysterious; when faced with what to turn off, drop rearview mirror textures first. The reasoning here is that you'll never spend enough time looking in the rearview mirrors to enjoy the detail there (when racing, at least). The only concern is if there is a car behind or not (the same goes for objects; the rearview mirror details can be dropped here, too). Next, off goes the sky texture. It looks nice, but it isn't critical for driving and the sensation of speed. (This is true of most sims, actually.)

During your quest for higher frame rates, you've probably noticed that by turning off some of the graphics options, the frame rate estimate number doesn't change. This may cause you to leave the box checked. However, I've found that certain textures—such as smoke texture—doesn't change the estimate, but it will ultimately slow the sim down and increase processor usage. These are the kinds of things you want to turn off first if you must turn things down because, while it won't affect your processor occupancy number at the start of the race, it will bog your system down noticeably when you smoke your tires, use too much throttle, or brake too hard.

PERFORMANCE WITHOUT CONTROL IS NOTHING

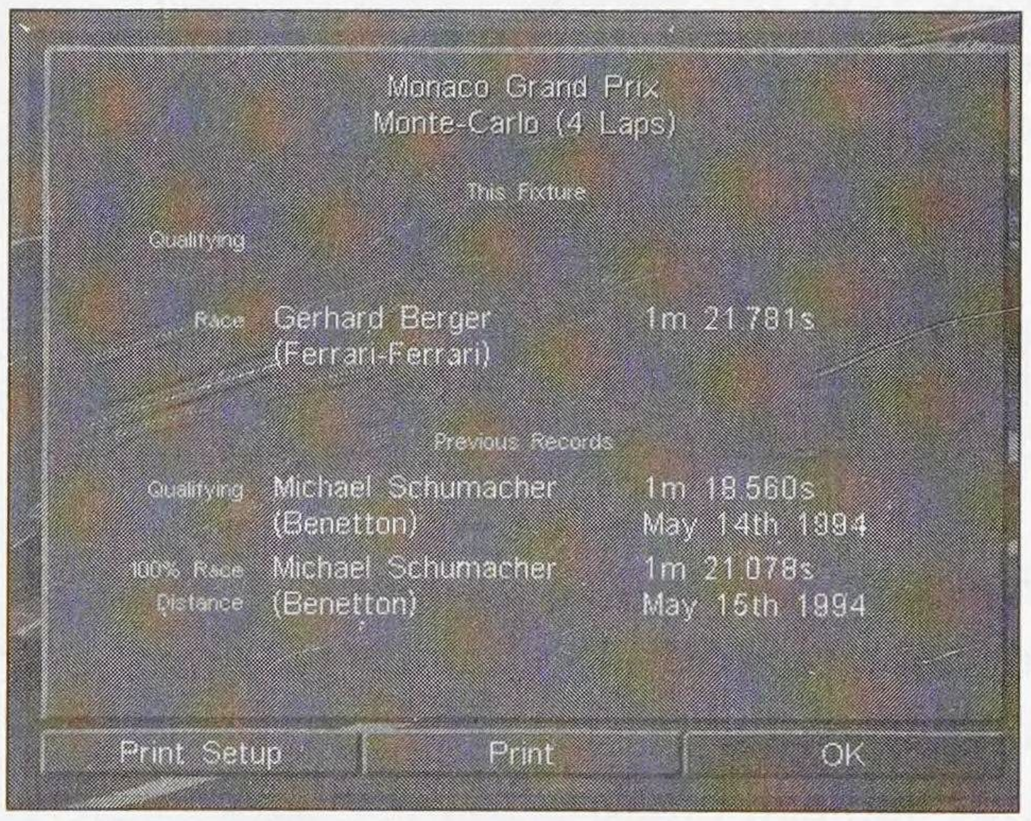
If you're serious about driving *Grand Prix II*, I suggest getting a good wheel/pedal combo. While it is possible to get faster lap times using a joystick and keyboard setup, it doesn't compare to the wheel and pedals for realism. *Grand Prix II* accepts either; however, as some of you may have noticed, *Grand Prix II* doesn't drive like any other racing sim. This is because it models F1 cars as true to form as we've seen. F1 cars are not turbo-charged, so power is instantaneous. You can spin your tires very easily. The same goes for braking ability. The exotic composite cars are very light, so braking must be handled with finesse.

Although car setup will be covered shortly, it is important to point out here that the way a car feels is very much dependent on its setup. For instance, if your car is set up very loose, it will be very hard to drive and will not impart very good feel to you. Furthermore, car setup has a lot to do with controller setup. In fact, many problems such as push (understeer) have been products of not enough controller steering lock, rather than poor suspension setup. So this is something to look out for.

To get you in the ball park, drive the stock setup on a track with steering help off. Adjust your steering lock so you can take the fastest turn at full speed and the slowest turn at a reasonable speed. As for the pedals, you'll want to adjust your low sensitivity as high as comfortable. This will make the pedals more forgiving; you won't spin your tires or lock up your brakes at the slightest touch.

LEARN FROM THE PROS

When faced with a new track, it is important to learn a few things. First, learn how fast you have to go to be competitive. This will help you keep track of how much work you need to do, but more importantly, it will be invaluable for car setup. Looking at lap records is a good place to start, but it isn't the best. *Grand Prix II* gives you the option to ride along with the other drivers, so take advantage of it. Just as in real life, learn from the fast guys. It is the best method for learning important clues and tips about the track. Set your opposition standard to Ace, and the opposition spread to 1994 levels. This will make everyone drive the fastest they can.



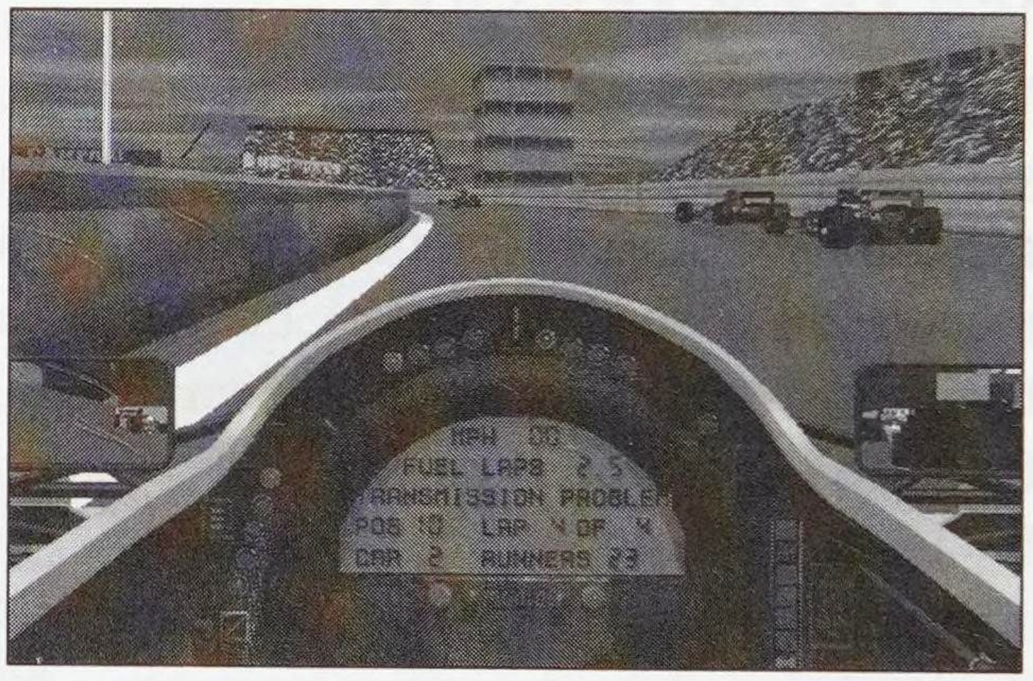
At the start of the race, move into one of the cars at the beginning of the grid and take a ride. Usually Michael Schumacher, Damon Hill, Gerhard Berger, or David Coulthard will be fastest, so you'll be okay riding with one of them. Note the speeds in all of the turns and straights. Most importantly, top speed is obtained in the longest part of the track and in the slowest corners. This will be important for car setup later on. Also note which driving line the best drivers are taking (they don't all follow the "ideal driving line" indicated) and where the best places are to pass. Not only is this entertaining to watch, it's all good, valuable stuff to absorb.

DRIVER'S ED

Of course, all of the previous will remain confusing if you don't know the track layout well. You need to learn the track. *Grand Prix II* makes this sometimes-frustrating step easy and enjoyable. Set as many driving aids as you need to get around the track.

> **TIP**
>
> **You may need to lower your opposition level to enable some of the driving aids.**

The most important thing for a beginner is the ideal driving line option (the F5 key). Note where landmarks are, as they can be indispensable for remembering what part of the track comes up next. If you press F6 and enable the suggested gear option, it can give you clues as to how fast you can go into the upcoming turn. However, don't get too attached to the actual gear you're using, as the suggested gear will most likely change when you start adjusting the car setup. When you advance to manual braking, base where you apply your brakes on track landmarks. It'll take some trial and error, but not only will this help your lap time consistency, you'll need to start formulating references now for future comparisons.



GETTING THE FEELING

Hang around motor sports long enough and you'll undoubtedly hear about one of the oldest racing debates: Is it driver skill, chassis setup, or the best equipment that makes one driver faster than another? As you can imagine, there are many philosophies on this subject, and there is no clear winner; although, the current F1 battle between Williams (pro equipment) and Ferrari (pro driver) seems to be favoring the driver (Schumacher) argument.

Without continuing this debate here, the elusive answer depends on the hypothetical driver's current skill level, because once you reach a certain level, chassis setup is more important than the best equipment. Even if you have all of the best stuff money can buy, if the setup is wrong it just won't work. Furthermore, if your chassis is setup

well, your driving will improve. Luckily, in *Grand Prix II*, you can turn off all of the failure options, so equipment can be taken out of the equation. That's why, even though this chapter discusses some driving tips, it will mainly concentrate on chassis setup. But first, here are some other concepts to consider.

WE'RE ALL DIFFERENT

A car setup will directly influence how a car handles or feels (see Figure 8.2). Of course, this is a subjective characteristic; the way people like their cars to feel varies from person to person. What suits you may not suit many others. You might like your car to be pointy (have lots of steering), but many other drivers many not. Thus, the concepts behind chassis setup will be discussed rather than providing specific numbers to use. Equipped with the right information, you'll be able to setup your car the way you want it.

Be aware that there are many ways to achieve the same effect. So there really isn't an ultimate setup that will suit everyone. While there are changes that will help everyone, some that make you go fast won't work for others due to different driving styles. So keep that in mind during practice and testing.

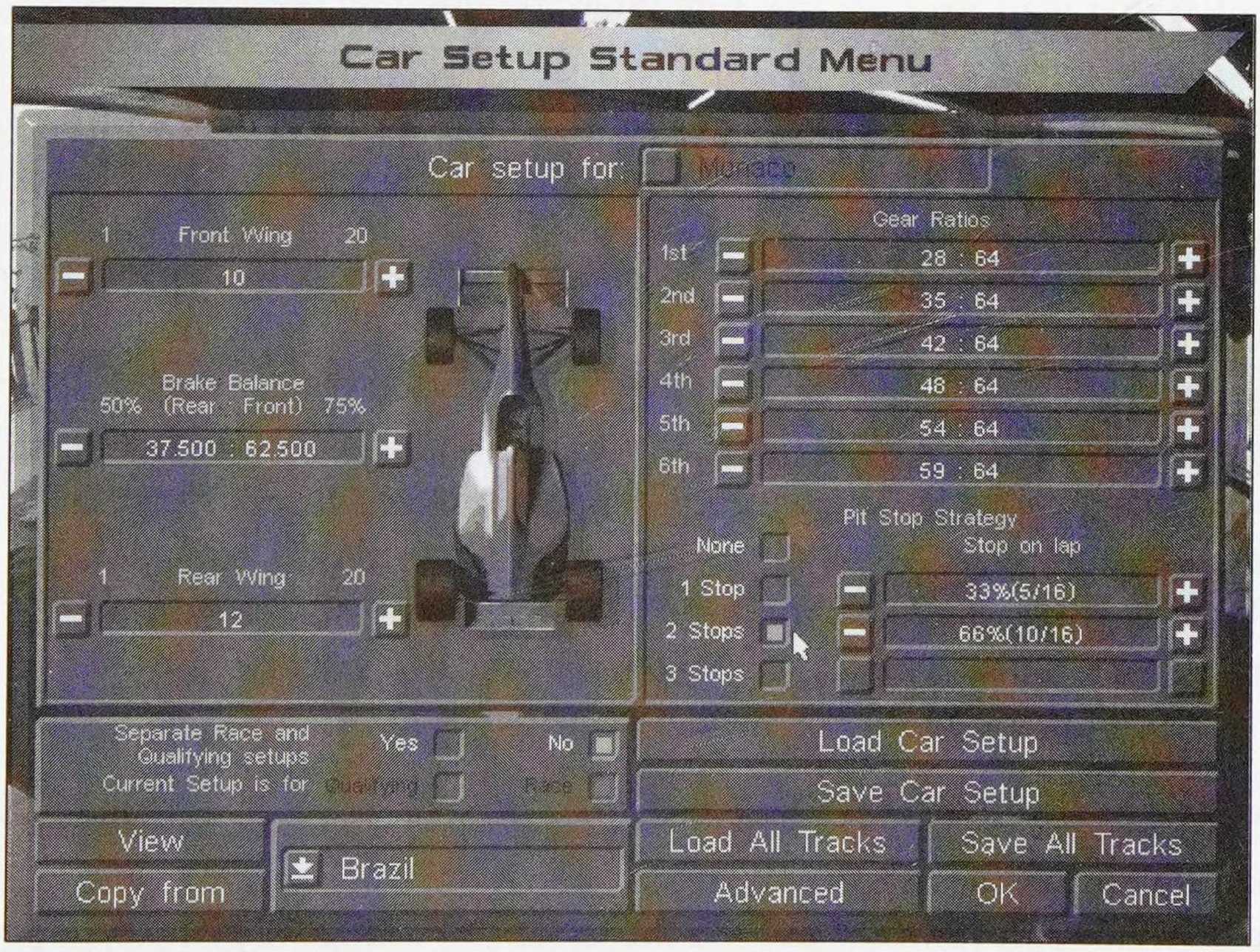


FIGURE 8.2: Your individual setup affects the way the car handles or feels to you.

TESTING, TESTING, TESTING

We'll be concentrating our efforts in a practice session at Monaco. Before entering Practice Any Circuit, go to Drive Options and set the Level of Difficulty to a level that matches the driving aids you require. Even if you're very familiar with the Monaco circuit, at the very least set your opposition to Semi-Pro, so you can enable the Indestructible mode. You should also disable all failures in the Car Realism menu during practice. This will cut down repetitive restarts from the pits after major bobbles. You'll be making many stops just in the course of testing anyway. You don't need to be stopping for any other reason at this point, as it doesn't accomplish anything.

The following other testing tips will help you isolate any benefits or hindrances any setup changes might bring about:

- Only change one thing at a time, and then go out and take a few laps and note any time changes.
- Be sure to use split time references; it'll make it easier to determine on which part of the track you need improvement.
- Remember that your tires are the only thing keeping you on the road. Naturally, they wear as you drive on them. Since you have an unlimited supply of tires during practice, make sure you start your test laps with each new setup on a brand new set of tires.
- You can take a shortcut back to the pits by pressing Q any time when you're out on the track.

As you delve further into setup and race car dynamics, you'll begin to realize that racing is really a complex exercise in balances or compromises. The most basic balance is the relationship between oversteer and understeer. Car setup adjustments control this most basic balance. However, you need to realize right from the start that if you change one thing, it'll usually affect another. Here's the first example.

MECHANICAL GRIP VERSUS AERO GRIP

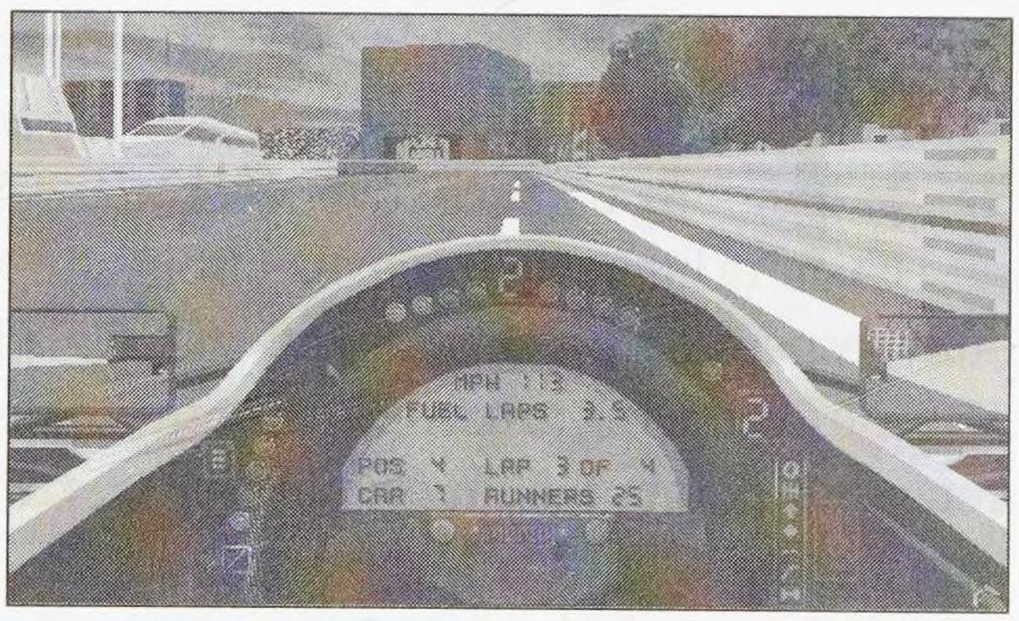
Okay, tires keep you on the road. So naturally, the better you can get your tires to grip, the more force they'll be able to withstand and the faster you will go. In general, grip is thought of as either mechanical grip or aerodynamic grip. Mechanical grip is

generated by tires, suspension geometry, dampers (shocks), and springs, and aero grip is generated by wings and the underside of the car. Because aero grip requires airflow, and higher speeds generally increase airflow, aero grip only becomes a grip factor when the car is moving at a high enough speed.

Mechanical grip is not speed dependent; however, mechanical grip can affect aero grip. This is because the suspension setup determines how much a car can change ride height or chassis pitch—which will both affect aero grip. This might sound very confusing now, but it'll make sense with specific examples. However, the important thing to understand now is that aero grip generally governs high speed performance and mechanical grip manages low speed performance.

GEAR HEAD

The easiest way to gain speed at any track is in the straights. So the first thing to do at any new track is see how fast you can go down the longest straight. If you've driven around Monaco with one of the better drivers at Ace difficulty level, you'll notice they're able to obtain top speeds in excess of 178 MPH down the Lowen Tunnel (G) straight right before braking hard for the Nouvelle chicane (H). The stock default car gearing setup will not allow you to reach that speed. Furthermore, the RPM range is not optimized.

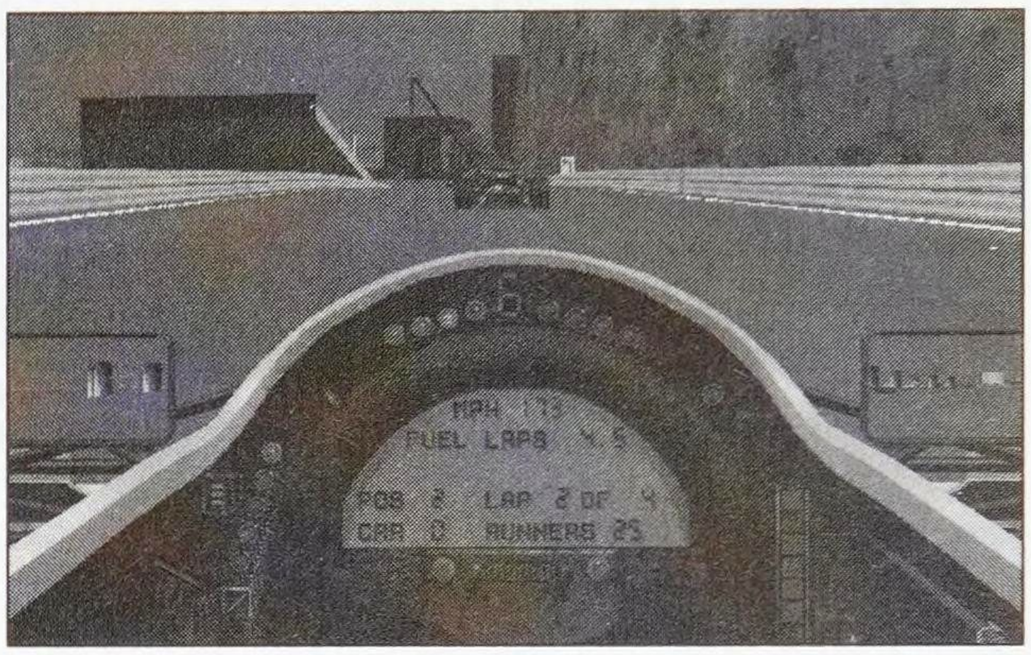


While there is no tachometer on an F1 car, there are a set of lights on the top, left side of the cockpit that indicate the best usable RPM range. If the red light is on, it means maximum RPMs have been reached. Although all F1 cars are equipped with rev limiters so you don't need to worry about blowing the engine up from over-revving it, note that if you drive around with the red light pegged, it means you are no longer accelerating.

Generally, one of the keys to going fast in a racing car is to always be accelerating or braking as hard as possible. Anyway, you'll want to adjust your top gear so the red light will just come on at the last moment before you have to brake on the longest straight. Ideally, the rest of the gears should be spaced so the first green light lights up when you upshift (after the red light comes on) to the next gear. This will get you in the ball park. However, you may have noticed that the Pro level top speed cannot be equaled at Monaco with any gearing change alone.

WINGIN' IT

You can blame the lack of top speed on excessive rear wing setting. However, things to note here are that if you lower the wing setting, you will end up going faster down the straights, but you'll change the current car balance. This will change the handling of the car; if the changes are drastic enough, they will cause your car to be slower in medium and high speed turns.



Is the extra straight away speed worth slower speeds in the turns? That's something you'll have to figure out in your tests. However, we know from watching the other drivers that a maximum speed of 178 in the longest straight is a good place to start in order to equal or better their lap times. Since the wing settings affect top speeds, and gearing affects top speeds, if you change the wing setting, you'll have to change your gearing as well.

Any novice can go fast in the straights. Because you're not drag racing, races in *Grand Prix II* are going to be won in the turns. If everyone can achieve the same straight line speed, whoever is able to take the turns faster is going to win. While the rear will increase drag (and decrease top speed), the front wing does not. However, it is critical for handling balance (oversteer, neutral, or understeer).

If you're interested, consider front and rear wing settings at 11 and 11 or 10, respectfully, especially if like your cars to have a lot of steering. Top gearing is set at 56:64. Use the front wing to correct balance problems in medium and high speed turns. Good reference points are the Sainte Devote (A), the turns into Casino (B) and Tabac (I), and into the Swimming pool complex (J).

And remember, second place is the first loser!

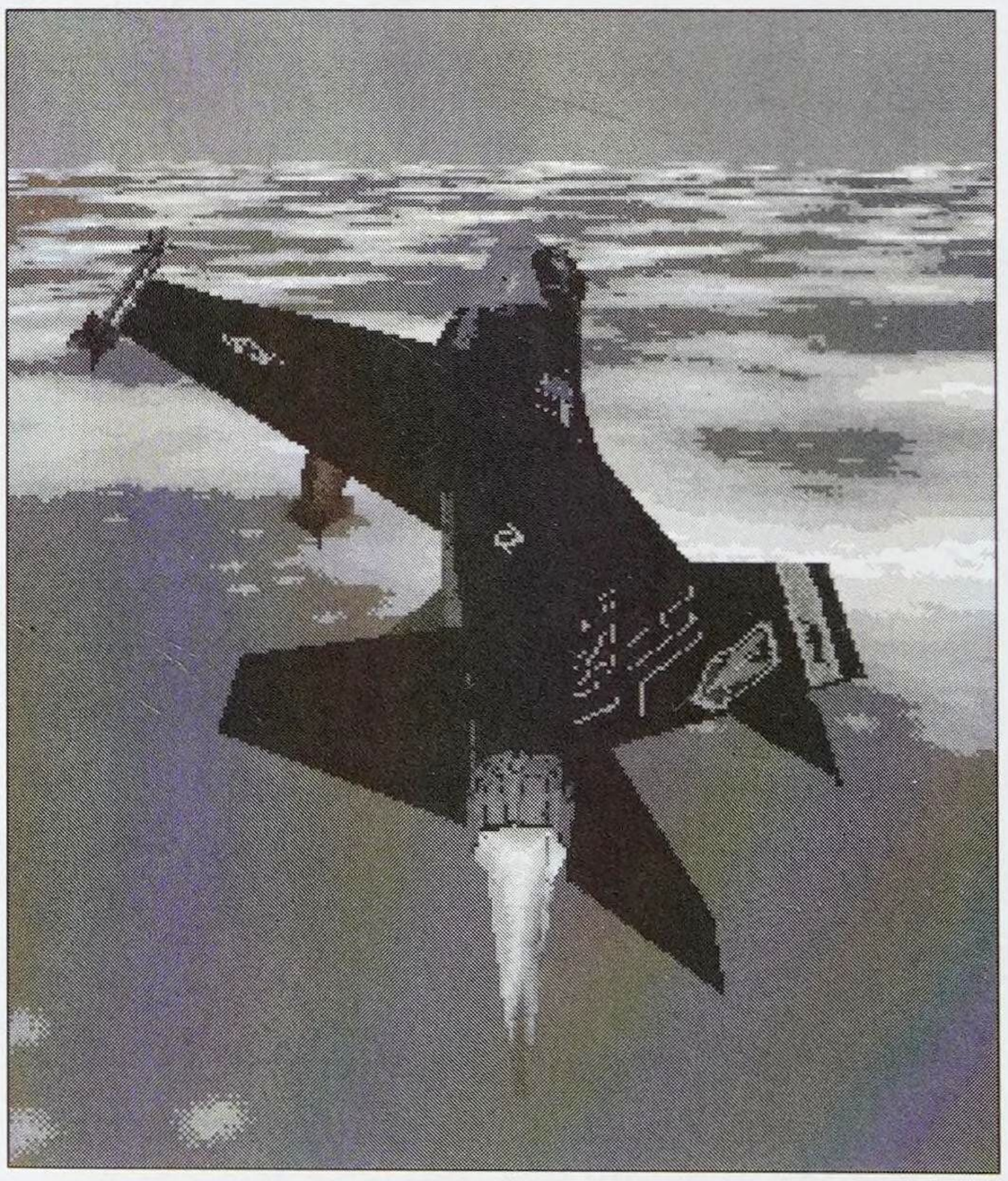
9

Back To Baghdad

The "ultimate Desert Storm Simulation" finally arrived from Military Simulations, Inc. *Back To Baghdad* supplies a long-awaited fix for F-16 junkies. It hit the market in an incredibly timely manner—as problems with Iraq surfaced in headlines recently.

KICKIN' UP THE DESERT SANDS

The result of the long labor of love for Military Simulations, Inc. is slanted more toward the simulation end of the spectrum than previous games in this genre. Much time and effort went into assuring realism over simple eye candy. Be prepared to spend some time learning to effectively operate your F-16. This chapter will focus on getting you off to a successful start.



GETTIN' READY TO ROCK 'N' ROLL

It goes without saying that you'd better have a stick and throttle for this sim, and a programmable one if possible. The game has built-in support for the Thrustmaster F-16 FLCS stick and F-16 TQS throttle. They are excellent and get you into the air with a good switchology setup almost instantly. Rudder pedals are a nice touch, but you really don't need them in this fly-by-wire simulation.

The computerized, digital flight controls in a real F-16 correct out pilot rudder input pretty quickly to keep the aircraft flying with no slip. The game models this feature accurately (see Figure 9.1). You may need a touch of rudder while landing or while easing the gun pipper over the bandit, but keyboard rudder controls will serve for these duties. Spend the money on a programmable stick and throttle setup. You can then program one of the many buttons to give you a touch of left or right rudder when necessary.

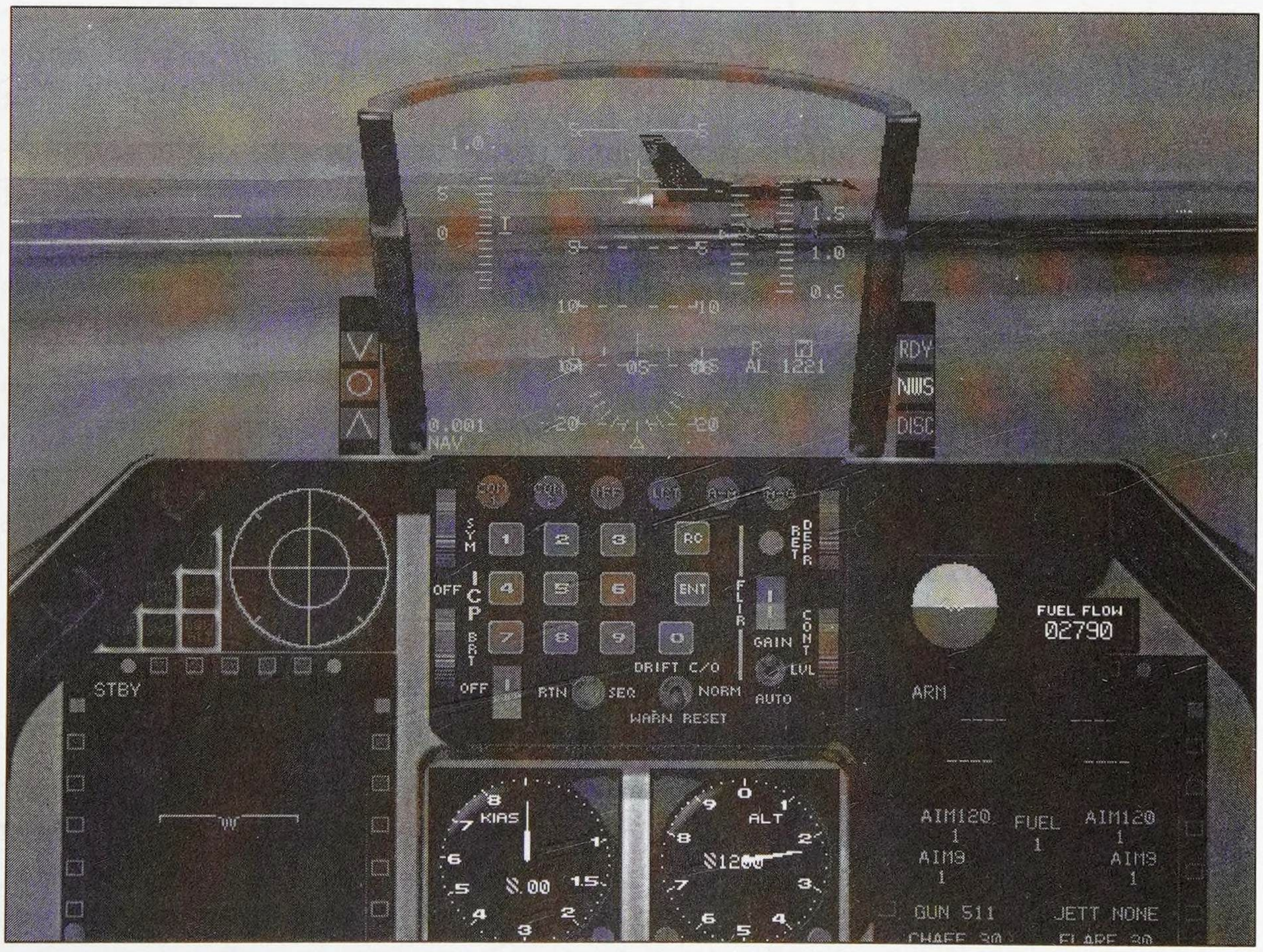


FIGURE 9.1: The game models the F-16's real computerized flight controls very well.

Download Some Helpful Goodies

While this simulation was still just a gleam in the eyes of developers at Military Simulations, Inc., CEO Bob Carter said that the game would "assume you were knowledgeable about the F-16." This is reflected in the rather brief manual supplied with *Back To Baghdad*. The manual really isn't detailed enough for a simulation of this depth. Fortunately, a quick trip to `http://www.military-sim.com` will allow you to download the Supplemental Online Manual. This guide has much more detail on proper operation of the aircraft systems; get it before you even start on the training missions. There is word that the packaged manual is being rewritten and will include the current supplemental information and further improvements.

Additionally, there will be a *Back To Baghdad 3-1 Tactical Manual*. Advertised as "absolutely everything you ever wanted to know about flying the F-16 in combat," it can be a large help in playing the game. The mission summaries will tell you where and what type of enemies you face and how to engage and defeat them. Use the manual to learn to operate the F-16, but try the missions a few times before you use the mission summaries as a cheat to succeed. After all, you wouldn't have a cheat sheet in real combat and that's what this simulation is modeling. Be brave; take 'em on without knowing exactly what's out there. You'll really maximize the challenge inherent in this sim.

While you're at the website, download `MSI PAT2.ZIP`, a patch that fixes problems with three of the missions: A-G Radar 1, Tallil Ho, and Munitions Strike. If you really want full detail, `B2BPAT1.ZIP` will supply texture mapped terrain over 12,000 feet. This is a nice touch, but won't change the game; it's not a must. The site also has a Controls Calibration and Setup page, with support for some of the more popular flight controls. At the Online Ordering page, Military Simulations, Inc. sells three Tactical Pilotage Charts for Iraq and Kuwait ($30) to help you plan and execute your missions.

Get Set Up

Now you're almost ready to begin. Before you tackle the flight training, set the difficulty level. At the lower levels, not all features are available. For example, when flying the A-A Radar 1 mission at Training level, the Range While Scan mode of the radar is not included. You can try to select it as the mission brief directs, but it won't be there. ACE is the preferred mode; after all, you picked this sim for its realism. It's definitely more difficult and gives a very realistic feel to flying. If you find it's just too tough, you can always ease off to a lower level. At Ace level, your workload is going to be high.

Expect to *die* in training a few times. When you've passed the course, you'll be glad you took the challenge.

TRAINING BEFORE GETTING THOSE KILLS

The first training mission is a simple survival exercise. If you can live through practicing take-offs and landings for six minutes, you pass. That equates to about twice around the pattern at King Khalid airfield. Remember, the throttle must be at idle to start the engine; fire up and quickly pull out on to the runway next to the leader. When he rolls, go full throttle and stay with him. Raise the gear as soon as you are airborne, and follow lead around the pattern.

If you lose him, don't worry. Just fly a simple box pattern. Runway heading is 130, so at 500 feet AGL, turn to 040 and hold the heading about 15 seconds. Then turn downwind on heading 310 and level at about 1,000′ AGL. A 5,200-pound fuel flow will keep you close to the desired 300 knots. The runway will be in the left view. Passing the approach end of the runway, ease the fuel flow to around 2,500, drop the gear, and roll into a descending left turn to line up with the runway. Put the Flight Path Indicator on the end of the runway and drive on in.

The pattern is normally flown using Angle Of Attack and not airspeed for a reference. Keep the AOA in the 6–10 degree range with a maximum of 13. You can check the AOA gauge on the down cockpit view. The resulting airspeed will be in the 170–200 knot range. Remember, pitch controls airspeed and power controls sink. If you start dropping low, add power. When you are over the runway and descending through 100 feet, ease the power out and raise the nose slightly. Touch-down speeds around 130 knots will do fine. A piece of cake! Now add power, and go do it until you don't even have to think about it. Don't run out of gas!

CLOSE IT UP

The second mission is simple formation flying. Remember how you couldn't stay with lead in the pattern? Now you'll have to! You'll start airborne with lead about half a mile in front. This mission will show Complete if you simply get close to him one time. Don't allow yourself to be satisfied with that! You'll probably lose sight of him several times as you learn to make small corrections with the flight controls and throttle (see Figure 9.2). A good idea here is to use the radar to give you range and closure information. You should also select the JTIDS display on the other MFD; it's a good

overview. Turn on the radar, select TWS mode, and select the MRM as the weapon. Now you'll get range and closure in the lower right corner of the HUD. Use it!

Outside of a mile, you can close in excess of 100 knots. Inside of a mile, cut your overtake until you have about + 50 at half a mile. As you close, decrease the closure linearly; at .3 have + 30 knots or less. If things start happening too fast, chop the power and thumb the speedbrake out. When you have it under control, stow the boards and start over. Small changes on the power and lots of patience will win the day.

While these aren't tiger rejoins, you have to learn to walk before you can run. Save the burner/boards rejoins until after you're proficient in the easy ones. When you have lead sitting just above and left of your Glideslope indicator on the left side of the HUD, you're where you need to be. Now drive in this line until you can see his planform clearly. If you can't see his bank change, you're too far out. Figure that you're doing well if you're about .1 away and good if you stay within .2 miles. Now, hang on the

FIGURE 9.2: As you make small corrections, you might lose sight of the lead several times.

wing for about 5 minutes or so. When you can do that, you've filled the formation square and are ready to move on.

The next set of training missions are perhaps the most important for campaign success. You've got to know the radar modes like the back of your hand. Both Air To Air and Air To Ground must be mastered, and you've got to be fast and certain in the proper selection of sensors and targets. But that's another story!

10

IndyCar Racing II

For some, the ultimate *IndyCar Racing II* achievement will come through missing the walls at Detroit and Australia or the grass at Elkhart Lake and Portland. Certainly such a feat is nowhere as easy as it sounds, but for the seriously dedicated, the absolute pinnacle would have to be considered a full-distance, "damage-on" race victory over 100-percent strength opponents. There were scant few who were able to pull this sort of thing off in the original *IndyCar;* things have become even tougher in this new installment.

A TOUGH ROAD TO FOLLOW

Now while this chapter won't offer such a lofty guarantee as a full race victory, there will be some tips and strategies that, if combined with the right setup for a given track and a whole lot of driving prowess, will aid in the cause (see Figure 10.1). I've found the following pearls of wisdom work well with an unmodified Ace setup to produce long-distance wins at most tracks with damage switched on and the competition set for 90- to 92-percent strength.

What it takes to move from a race victory over 92-percent competition to a race victory over 100-percent speedsters is hours of time spent in the garage and testing those mechanical alterations on the track. You *can* guarantee that the driving philosophy won't change; if you use this advice and win at 90 percent, you can combine the same tactics with the right setup and emerge victorious at 100 percent.

CD-ROM

Check out the CD-ROM included in this book for the demo version of *IndyCar Racing II*.

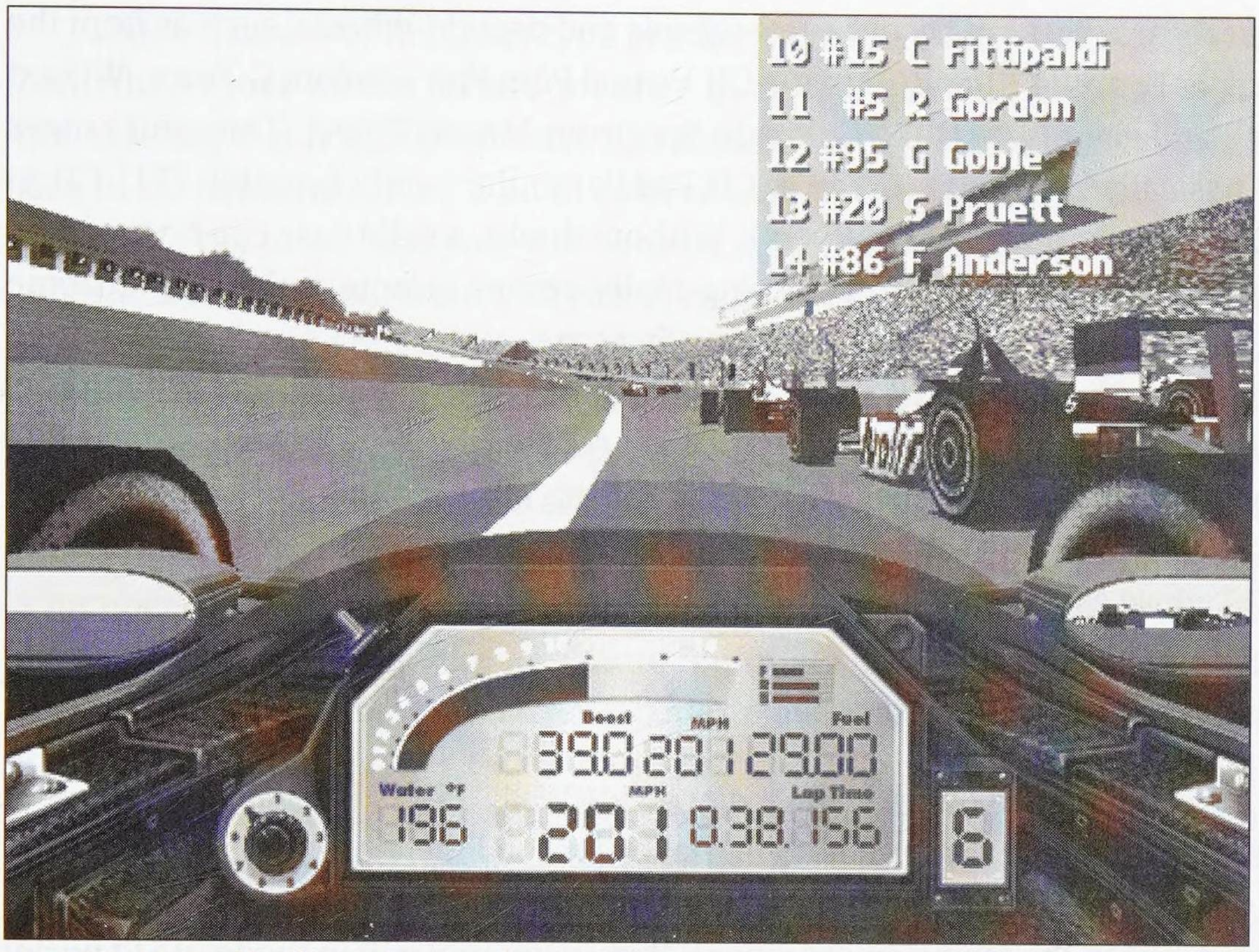


FIGURE 10.1: You'll need to tweak your setup to move up in the ranks.

PREPARATIONS

IndyCar II has gone much further than its predecessor in reproducing the real-life characteristics of a race car: The beast is suddenly breaking away from the asphalt in corners and transferring power through its rear tires. Since quick, jerky movements will spell nothing but disaster and a smooth, almost boring driving style has never been so important, you'll want to make sure your control device is up to the task.

A simple CH Flightstick can be just about the best joystick for driving simulations. It offers fluid travel, good range, and it just plain feels right. However, *IndyCar II* is by far the most demanding auto simulation ever designed, and although the Flightstick (or any other joystick-type device for that matter) is just fine for a big, thick oval like Michigan, it just doesn't cut the Valvoline anywhere else.

Simply, four appendages will do the job better than one; and at dangerous ovals like Phoenix, Nazareth, and certainly any through-the-street or road course in the IndyCar world, a steering wheel/foot pedal combo is a virtual necessity. The difference that a solid two-piece control device will make to lap times and overall enjoyment of the game cannot be overstated.

In that regard, you can try out a few wheels and pseudo-wheels, such as from the Thrustmaster Formula T1 and T2 to the CH Virtual Pilot Pro, Suncom G-Force, Wizard ProWheel, and even (gasp!) the Colorado Spectrum Mouse Wheel. This stuff ranges from the basically beneficial (G-Force, CH Pedals) to the barely bearable (T1, T2) to the bottom of the barrel (Mouse Wheel). Without doubt, a solid case can be made for a G-Force/CH Pedal pairing, but nothing really comes remotely close to Extreme Competition Controls' Competition Driving System.

It'll cost you a bundle, and it's only available through the manufacturer, but the CDS is the *only* way of getting consistently good road course laps in traffic with a breakable car. For any other racing sim, including *World Circuit*, *IndyCar*, and yes, even *NASCAR*, the Flightstick will do, but the harsh reality of *IndyCar II* begs for the precise mechanics of the CDS wheel/pedal unit. That said, it's time to get back to the game . . .

GETTING GOOD

So, how do you get good, as in really *really* good? Well, there's basically two types of drivers. Some drivers are firm believers in trial by fire, and therefore put in most of their practice under race conditions. Conversely, there are some who are also pretty darn good drivers, yet in the racing environment, they inevitably wilt in moderate to heavy traffic, which are the conditions you will race in most of the time (see Figure 10.2).

FIGURE 10.2: It takes practice to get really good in all levels of traffic.

Those who are of the latter type practice in *practice mode* with an indestructible car, while those of the former practice in *race mode* with breakable machinery. Considering that if real-life drivers had the chance to practice their race smarts outside of an actual race, they'd do it; so because you do, you should.

That's not to say that your first time on a new track should be conducted with 30 other little monsters out there with you. Preseason Testing should be the only choice until you've got a handle of the lay of the land, and that means until you know every turn, every nuance off by heart, and can crack off some decent lap times. Yes, it takes some time, but if you wanted arcade racing, you wouldn't be reading this now, would you?

Preseason Testing (with no other cars on the track) will also give you the chance to learn how to overcome all the other little obstacles that stand in your way. There's a number of *easy outs* to simplify things for absolute beginners, but don't necessarily rely on things like Spin Recovery, Auto Shifting, and Braking Help when these aids will be eliminated in time anyway. Grab the default Ace setup, get in the car, and repeat to yourself, "Trial by fire—it's the only way."

When you first hit the track, check out the graphics. If you've got a Pentium 100 or above, you're pretty much in the clear with everything turned on. But, since the loss of even a fraction of a second's worth of visual information can spell disaster, less fortunate souls with Pentium 90s or below will want to tailor the graphics to maximize frame rate. Killing grass textures, horizons, crowds, and even road texture will all help speed things up, but be careful not to knock off object textures, as that'll remove the very necessary road course brake markers too. Keep the *racing line* (rubber marks) turned on as well; they indicate the most traveled and expeditious route, especially through turns.

THE TRACK

IndyCar II tracks come in two distinct forms, the oval and the road course, and there's a world of difference between the two. We'll deal primarily with the oval; in particular, Michigan International Speedway, a relatively safe place to come to grips with the handling and characteristics of an IndyCar. Here, there's essentially two big turns and the same number of straightaways; what you want to do is straighten out the turns so you can spend more time going fast through the exit and then on the ensuing straight (see Figure 10.3).

As mentioned earlier, you'll want to start in Preseason Testing, and stay there until there's no mistaking when you should be doing what. Begin by finding a smooth, consistent groove and driving rhythm, one that lets you lay low in the turns, swing out to the

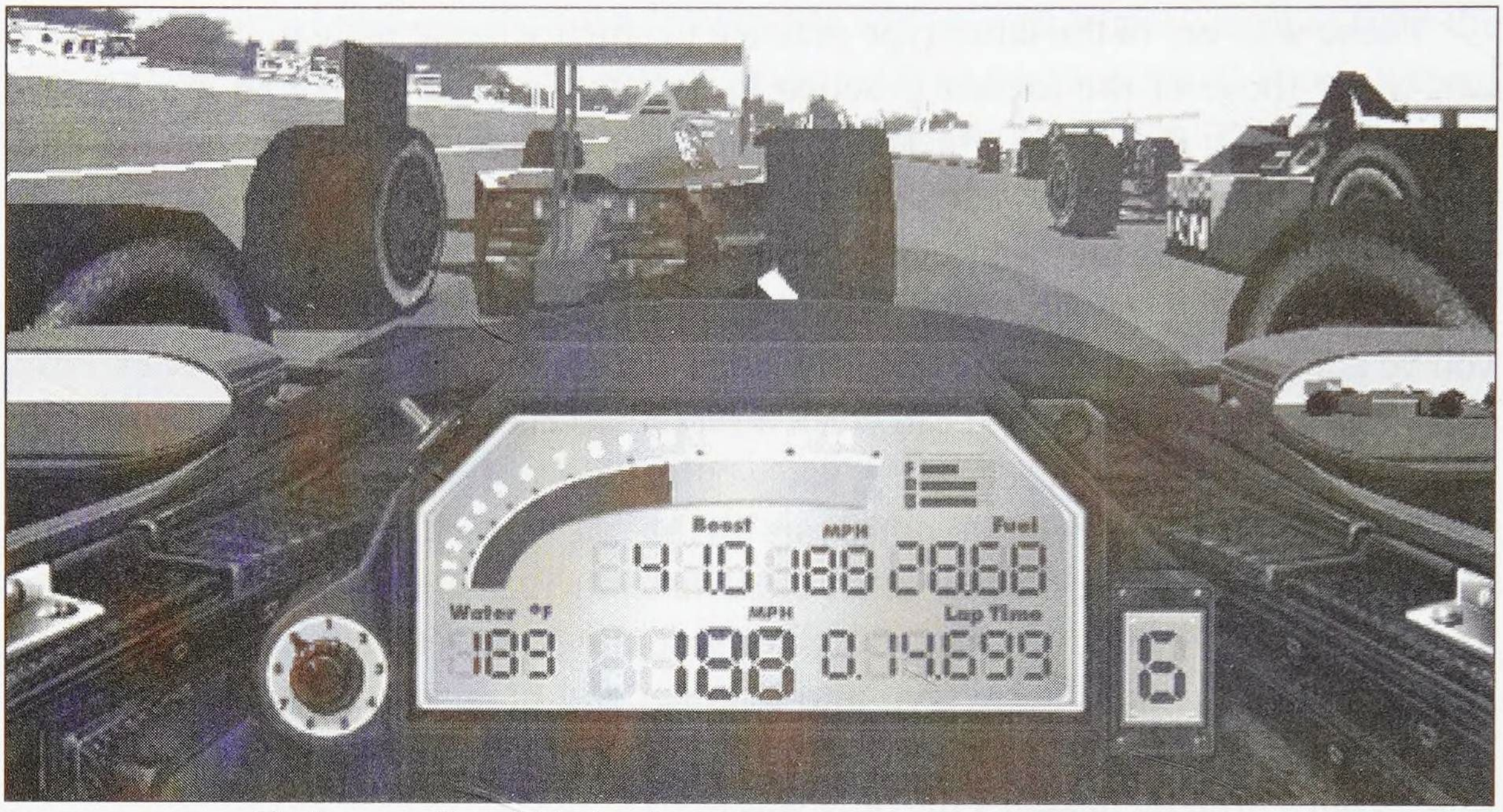


FIGURE 10.3: Tuck yourself right behind another car, so the car will *break the air* for you and you can pick up speed the closer you get, which allows you to *slingshot* past.

outside wall for the straightaways, and keeps tire squeal to a minimum (squeal always signals a loss of speed). Remain close to that outside wall for the bulk of each straight, until you hit the turn-in point for the next corner, which should be as late as possible (see Figure 10.4).

That turn-in point should always be the same spot, but inevitably will be bumped ahead as you improve. For consistency, watch for markers—signposts, trees, billboards, anything that'll help you determine the ideal braking or acceleration points—and adhere to them until you feel you can *go in* a bit deeper, and then pick new ones. On the Long Beach front straight for instance, the first billboard on the outside wall is *the* place to hit the brakes.

Be observant by watching the tach and speedometer, but keep abreast of what's happening outside the car as well, and remember that you're in control of a constantly changing vehicle. Decreasing fuel load and warming tires will have an effect.

FIGURE 10.4: A slight crunch (note the bent nose cone) may compromise speed and handling but shouldn't mean your race is over.

GARAGE ADJUSTMENTS AND VIOLENT CRASHES

No matter how well you drive, chances are that even the Papyrus-supplied Ace setup won't be enough to win a race at 100-percent opponent strength. Ninety percent is a different story, but with the big boys, you'll have to whip out the old mechanic's license and start tinkering.

Although the number of hours you might invest in *IndyCar Racing II*, you many never construct an ideal setup for most tracks. Road courses are most difficult, as that perfect balance between speed and handling is a much tougher call. But a better car is out there, somewhere, and it's up to you to find it.

Whether you're out to beat the clock on that one glorious circumnavigation, or in search of a durable long-term performer, there's a number of similarities in the following steps. Generally, creating a screamin' demon for that record-setting lap is a good start, as later it can be de-tuned into a decent full-race car—one that won't reach tire burn-out halfway to a pit stop.

There is no magic answer to the set-up riddle, and undoubtedly some backtracking will occur as settings change, but generally you'll want to check out the gear ratios first (see Figure 10.5). If you're red-lining near the end of the straights, you're wasting

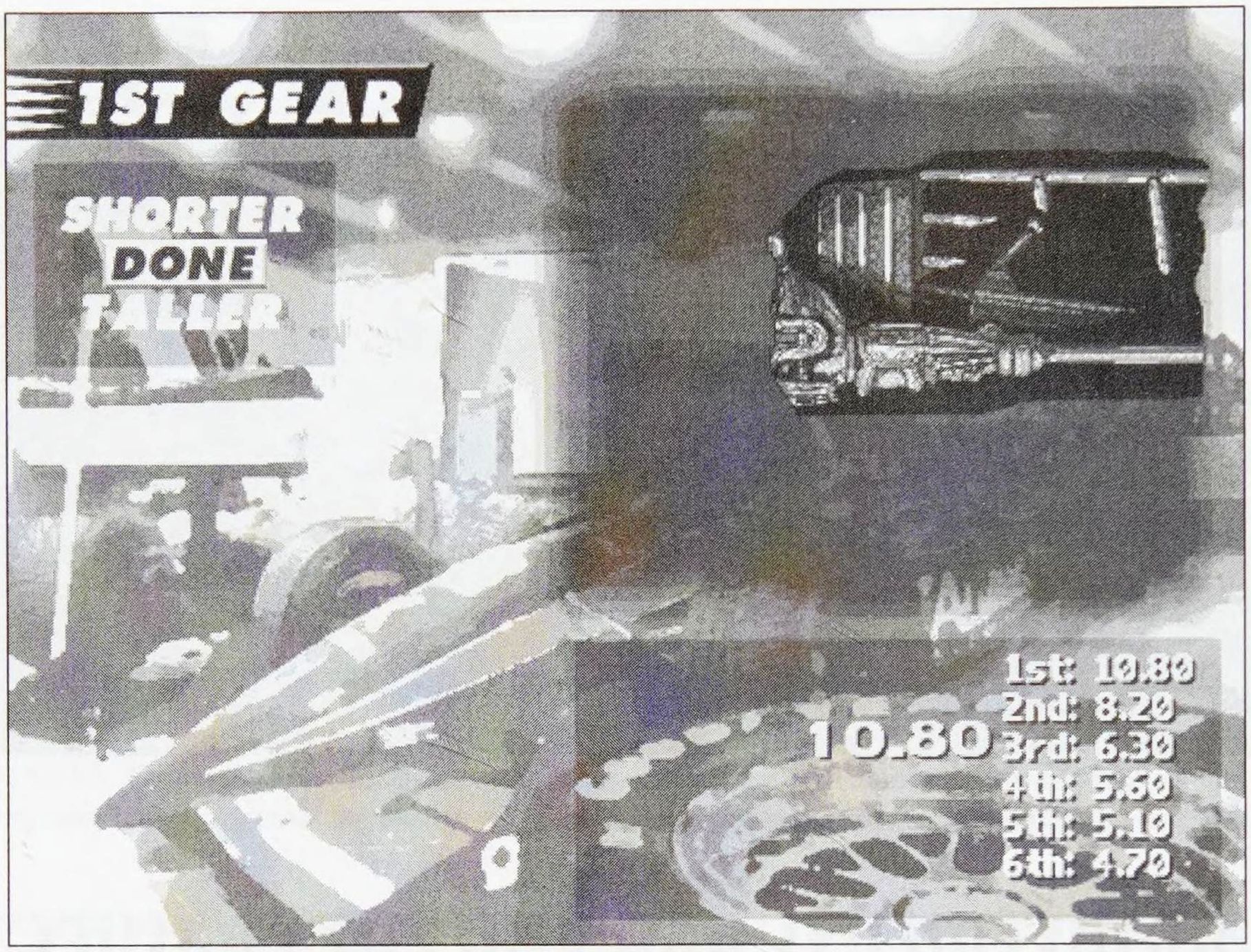


FIGURE 10.5: When setting up your car, check out the gear ratios first. Extra room in the top gear compensates for your decreasing fuel load.

time. You should also assume that with additional modifications and a decreasing fuel load the car is only going to get faster, so don't be afraid to give yourself some room by lengthening the top gear.

When you've made your initial gear selection, note the facts and figures on a piece of paper or save it to disk. This is a procedure that should be followed after each alteration, as car prep can get pretty darn complicated in a short period of time. Even more importantly, never ever make more than one change at a time without testing first, or soon you'll be wondering just which adjustment did what.

BURNING RUBBER

On the track (and if time permits), you should try running each alteration at full fuel, half fuel and low fuel—all long enough to determine whether your new change is simply running the tires ragged. There's nothing worse than a seemingly great setup killing your tires halfway to a pit stop.

Hitting the F4 key will display all the tire temperatures across the width of each tire, and ideally, the inside, middle, and outer temperatures of each tire should be equal (see Figure 10.6). That doesn't mean each tire should be the same temperature, just the readings across each slab of rubber. If one portion of the tire is considerably warmer, that tire is not contacting the ground as it should. Increasing tire pressure will bulge the tire's center (and cause you to travel much faster down the really long straights of Long Beach or Michigan), while deflating will cause the center to sag.

Now try overdriving the car through the turns. What does it do? Is there a pendulum effect as it swings out of turns, or does it want to drive straight up and into the outside wall. A loose car, for example, will kick its back end around, and that may well indicate a need for more downforce (more wing) in the rear, or less up front. This is where things start to get real tricky, and time-consuming.

Stagger (adding larger diameter tires to the outside wheels to compensate for the extra distance they must travel around a turn) is a good place to start some serious dialing-in of your car. Ideally, the right amount of stagger will have your car rolling through turns, without pushing up when coming out or skidding when turning in to a corner. As a rule of thumb, remember: Stagger the short tracks.

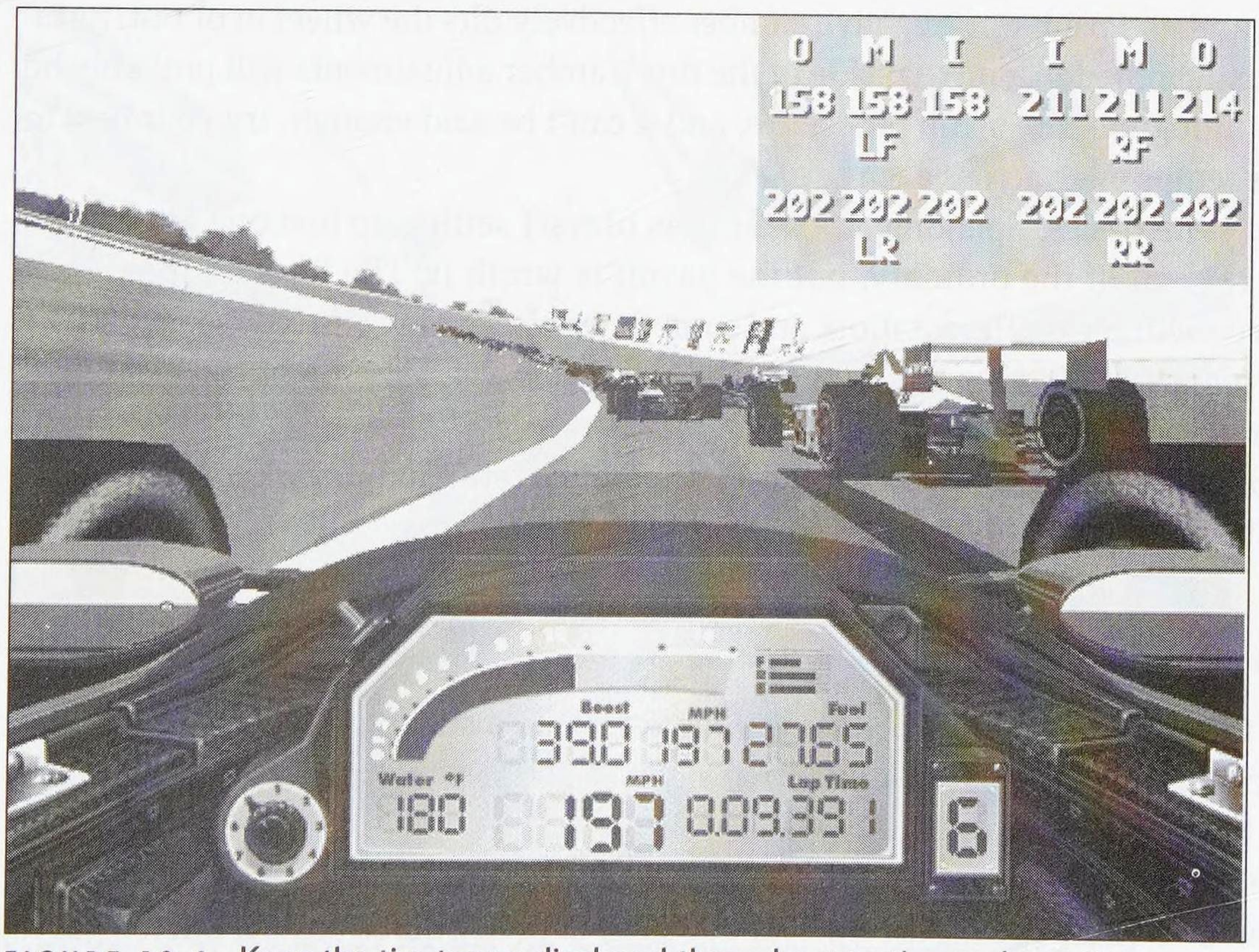


FIGURE 10.6: Keep the tire temps displayed throughout testing and practice.

WINGS AND SUSPENSION

Now it's time to check out the wings, fore and aft. These babies add or remove downforce, thus pinning the car to the track or allowing it to get practically airborne. You'll want less downforce at super speedways to keep speed up along their long straights, and more in the tight, curvy little courses. Often times, a gear or wing adjustment is all that's needed to turn a fast car into a flyer; although in this respect, the Ace setup is pretty darn good to begin with.

On to the suspension. Stiffening or softening individual shocks will help decide how much weight is transferred at that wheel. Again, this is real important in turns, and while stiffening the left front shock will help to tighten the car coming out of corners, stiffening the right rear will help with entrance speed and control. Also, since a softer shock places less force on that wheel, keeping the front right shock fairly soft will help decrease wear on that all-important corner.

Along the way, you should be closely monitoring the car's overall performance and handling characteristics as the barrage of modifications may have some nasty side effects. Run a whole bunch of fast laps, then pause the game after popping out of a turn. Check the tire temps. If a given tire is hotter on one side than another, try adjusting the camber. Positive or negative camber effectively tilts the wheel in or out, naturally placing more force on that side of the tire. Camber adjustments will probably be needed throughout the setup procedure, and it can't be said enough, try your best to keep tire temps even across each tire.

That's the basics: Spending several hours (days?) setting up just one car for one track is not out of the ordinary, but the payoff is worth it. The best settings come through patience, experimentation, and sometimes by accident. If you've reached the final step and still aren't satisfied, don't be afraid to go back to the proverbial drawing board.

And if all this is just too much, hey, there's still a few *Pole Position* games kickin' around the arcades. It sounds like you should be playing one.

HOT CRASH SPOTS

What's this? A how-to on demolishing your vehicle in a chapter designed to improve your racing ability? Well, yes, a quick one anyway, and why not? Crashing just doesn't get any better than in *IndyCar Racing II*.

The *numero uno* IndyCar crash site would have to be the front straight at the huge Michigan oval (here speeds are up over 200 mph in pretty quick order), but it's got to

be done right (see Figure 10.7). Start by assembling a full field, and begin the race from the back of the pack. Let the other cars go while you move slowly forward a few hundred yards, before hanging a sharp left into the pit lane exit.

Turn your car around and start backtracking. Stay inside the apron (between the white line and the grass), otherwise the computer cars will sense your presence and slow down before contact is made. When you see the leader coming at you, veer onto the course. Try to be running at over 150 mph for best effect, and target a vehicle that's running in close quarters with other racers; this way, you're guaranteed to take out a whole bunch in one whack. Prime examples of Michigan demolition can seriously damage more than a dozen cars, with parts flying hither and thither, and perhaps one or two reduced to mere pods. Whee!

After the dust has settled, go to the replay and toggle from camera to camera, vehicle to vehicle, and fire off some great photos by hitting Print Screen on your keyboard. Your mayhem can be displayed later in any bitmap viewer.

Not quite as carnage-filled but no less enjoyable is a little trick you can pull at Long Beach (and several other road courses, for that matter) (see Figure 10.8). Again, open the race from the back of the pack, but this time try squeezing down the right-hand

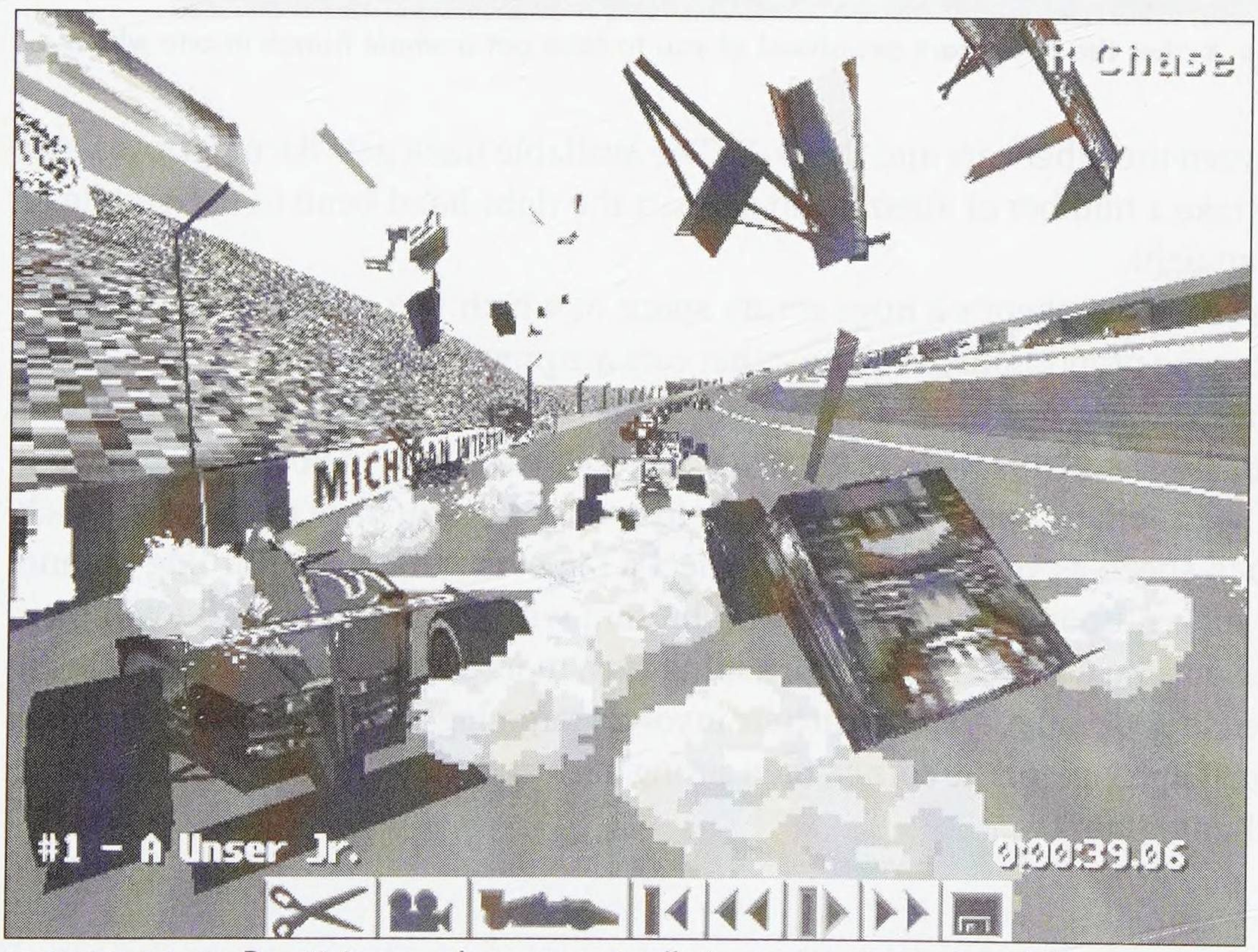


FIGURE 10.7: Practicing crashes can actually improve your racing ability.

FIGURE 10.8: Let the other cars get ahead of you to take out a whole bunch in one whack.

side, between the other cars and the wall. The available track gets darn narrow here, so it may take a number of attempts to get past the right-hand bend in the middle of the front straight.

Once you have, there's a huge empty space in which you can increase momentum to obscene proportions, as all the other cars are practically stopped in the middle and left of the track, one behind the other, for the hard right-hand turn ahead. If you were actually racing, this is also a great way to pick up a bunch of positions, but we'll save that for another time; you have bigger fish to fry. All you have to do now is pick up as much speed as you possibly can, select a target car that's just turning in, and nail that sucker. Boom! Not only will you hit him with *much force*, but he will then smack the outside wall nearly as hard, adding even more damage, and, with any luck, be reduced to pod status. A variation here involves targeting a whole line of cars, those who are still lined up for the corner, then sitting back and savoring the chain reaction. Thunk, thunk, thunk . . .

THE LAST WORD

Sadly, some drivers will have natural advantages over others. Real-life racers have a better immediate sense of what's going on out there (although they often complain that they can't actually *feel* the G-forces at work, the wankers). Obviously, people with good hand-eye coordination also have a solid head start.

So, what can you do if you're one of the unfortunate medium-reflexed majority whose racing experience has been limited to off-the-line contests in the family Pinto? Start by focusing on the task at hand, and build a sense of rhythm. Try to use the middle of the windscreen as your sightline, and keep it in the center of the track. *Never* let anger over a missed opportunity affect your driving style, and don't become *wing-fixated*. If you're too busy watching the guy ahead of you, you'll forget that he might be doing things you can't do with your current setup and/or ability level. Finally, watch and listen to the tach, 'cause it'll tell you a lot more than the speedo, and always shift just a smidgeon before 13,000 rpm.

Happy racing.

II

Silent Hunter

SI's *Silent Hunter* is a submarine battle simulation that has plenty of depth and detail to satisfy any fan of the simulation genre. Its interface and graphics do an excellent job of giving the sim'er a feel for the claustrophobic conditions of a sub as well as the tense excitement of submarine battle.

TACTICS FOR THE HUNTER AND THE HUNTED

In *Silent Hunter*, the most important thing to keep in mind is that you are perched on a fine line between being the hunter and the hunted. At any moment, you could go from stalking to fleeing. Put this transition off until the last minute by dividing an encounter into three phases: the approach, during which you set up the ideal conditions for the kill; the attack, which marks the transition from hunter to hunted; and the escape, which is, in the final analysis, the most important phase of the encounter.

THE APPROACH

Take the time to set up your attack. Unless you get a once in a lifetime shot at the Yamato, it's better not to attack than to attack poorly. It's almost always a good idea to wait for the lower visibility of night. If you come across an escorted convoy during the day, trail it until the sun goes down.

When you first come in contact with the convoy, note the range at which the destroyers become visible. Although your size is comparable, you sit much lower in the water, so you'll

CD-ROM

Check out the CD-ROM included in this book for the demo version of *Silent Hunter*.

see them before they can see you. Try to maintain this distance as you follow and assess your prey. As visibility decreases, get closer. Whenever possible, keep your nose pointed toward your victims: A side view of your sub will make a much larger dot on the horizon than a head-on view.

Identify the targets early on to get a better sense of the convoy's composition and its defensive screen. A quick rule of thumb is that multiple funnels atop a ship are bad (destroyers) and funnels toward the stern are good (the largest tankers and merchant ships), as shown in Figure 11.1. You can zoom in to the maximum magnification on the chart to get a better look at a target on those moonless nights (see Figure 11.2). Cheating, you say? Naw. Just tell yourself you're modeling the use of light-sensitive binoculars.

Eventually, you should sprint ahead of the convoy and wait in its path. While you're waiting, take the opportunity to search for a thermocline. This will make your escape much easier, so a bolder attack at a closer range will be less risky.

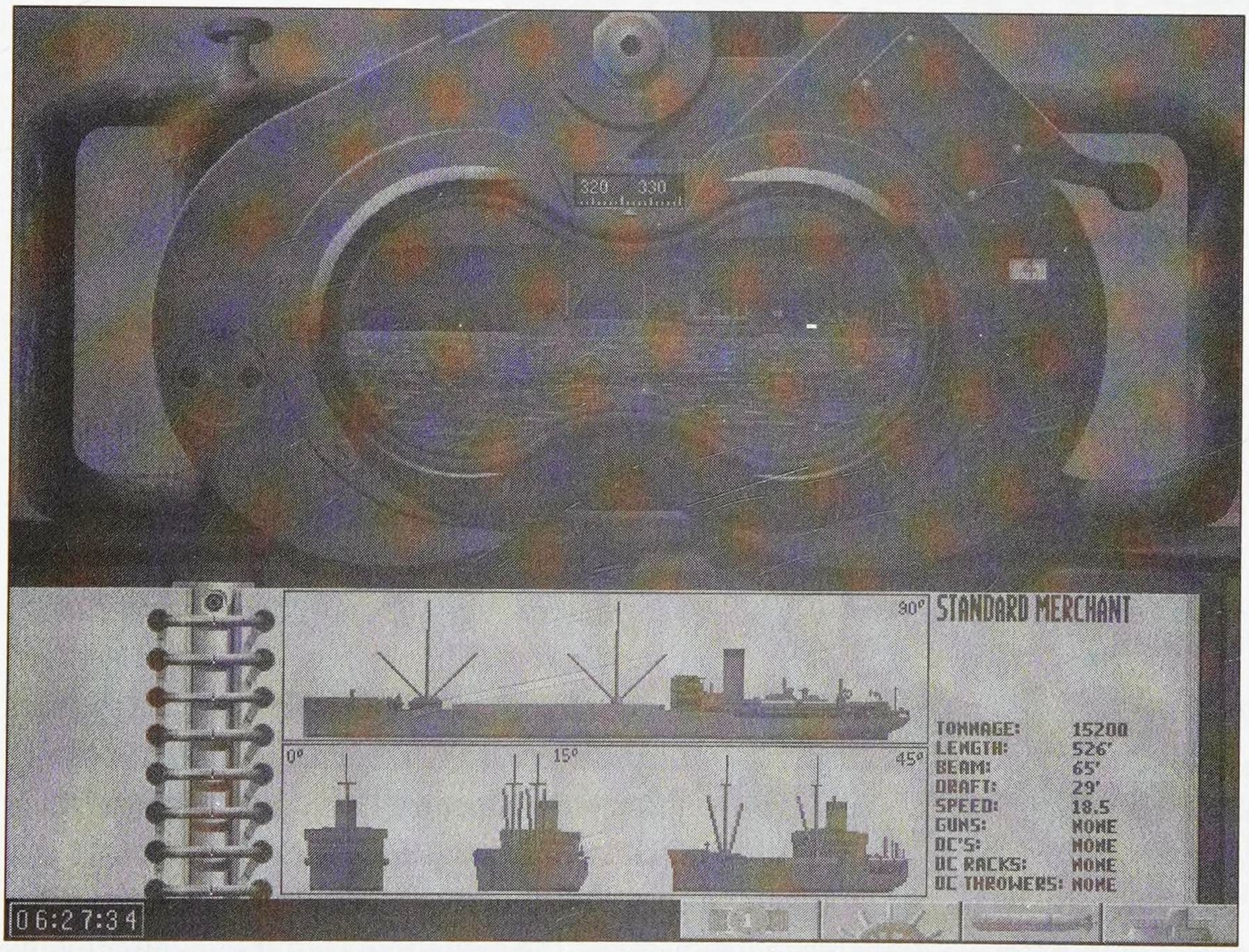


FIGURE 11.1: A standard merchant, weighing 15,200 tons, is one of the biggest commercial targets in the game.

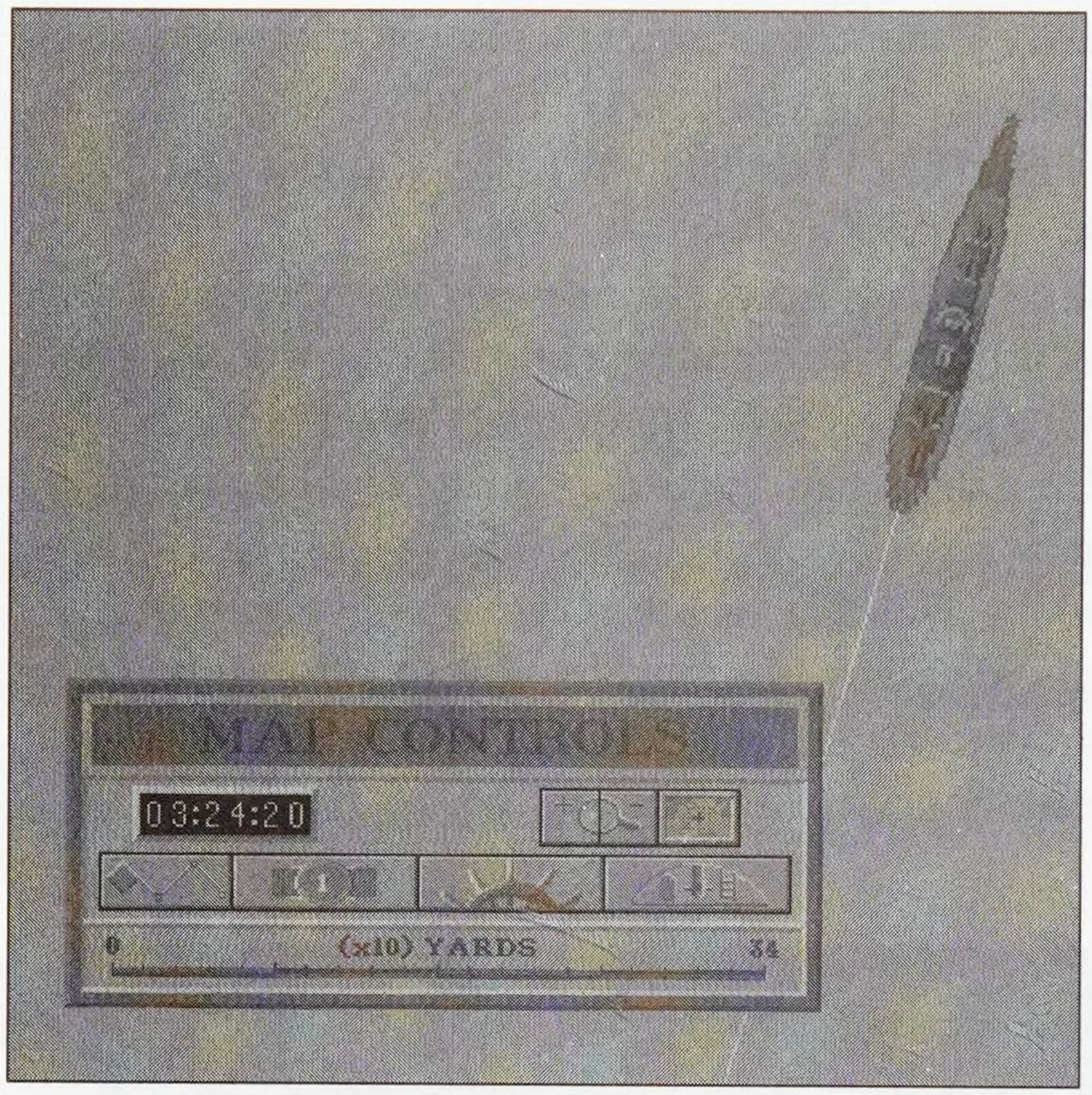


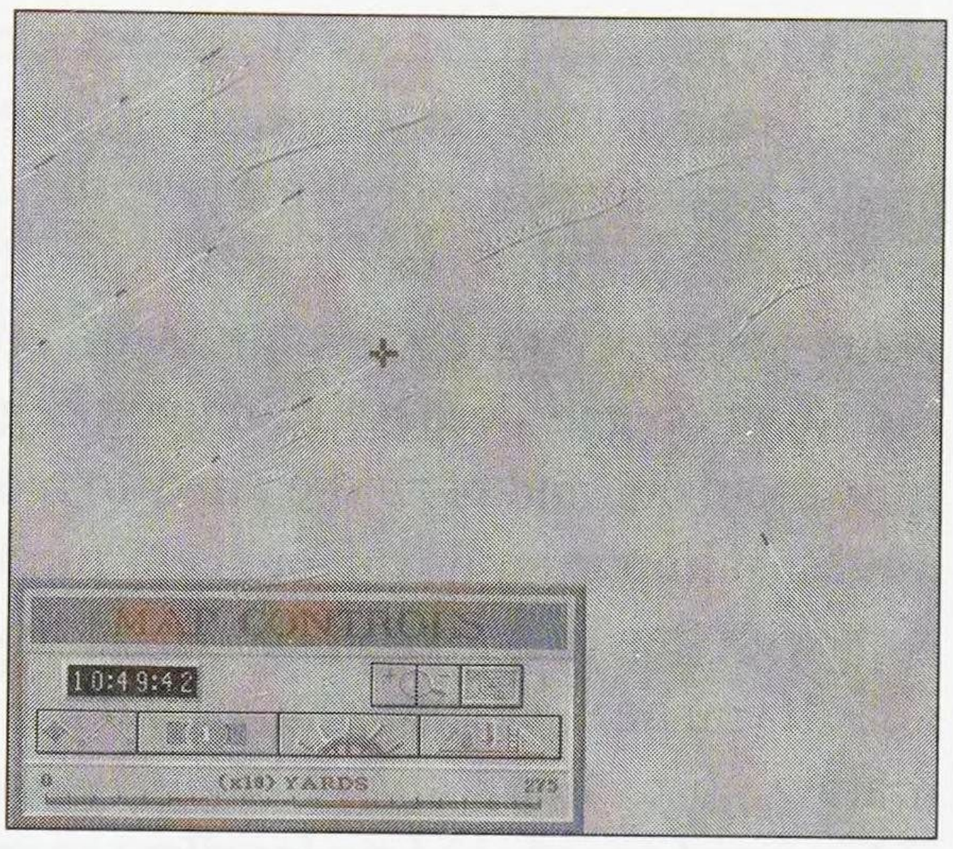
FIGURE 11.2: Although it's 3:30 A.M. in the middle of a moonless night, you can clearly ID the battleship, thanks to maximum zoom.

If you're spotted before you've reached your position, put all thoughts of attacking the convoy out of your mind: Your new priority is a quick departure. An often overlooked asset in escaping is the cluster of torpedoes in your boat. Snapping off a few shots at a charging destroyer may make things easier by throwing him off, or better yet, taking him out. And one less destroyer in the hunt makes a big difference!

THE ATTACK

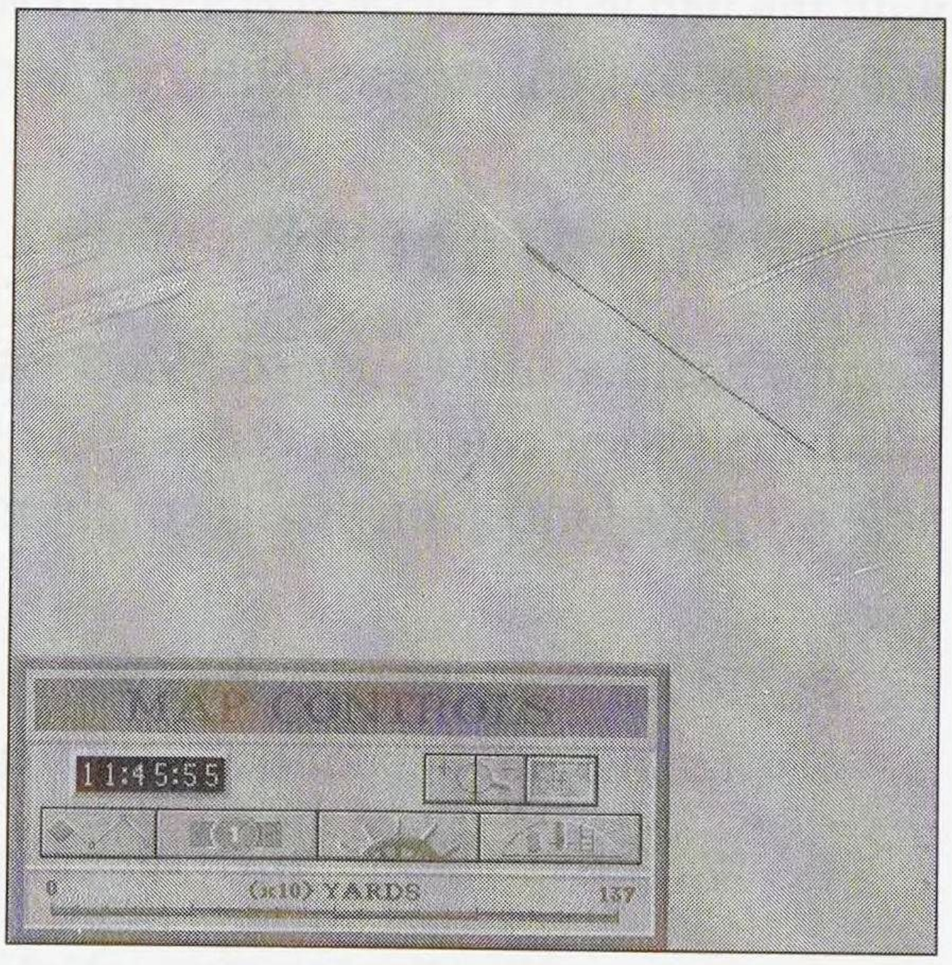
Early in the war, when you're still saddled with the unreliable Mark 10s, pile up your torpedoes on one target rather than spreading them out. You're bound to get more reliable results concentrating your firepower this way. Also, try to hit your target from a 45-degree angle. Both the Mark 10 and Mark 14 are hampered by detonators that are less reliable in a directly perpendicular impact. Keep in mind that an attack at an angle towards a ship's stern will increase the distance the torpedo has to travel, effectively reducing your weapon's range.

If you are taking on multiple targets, use the chart screen to designate them more quickly. Fire at the most distant targets first to give you more time before your presence is announced. It's tempting to stick around and watch the fireworks, but once your torpedo tubes are empty, immediately consider yourself a fugitive and plot a course away from the escorts as deep as you can dive.



THE ESCAPE

The most difficult part of an encounter is evading the uncanny accuracy and unwavering persistence of the Japanese destroyers. Although the pursuit of submarines in *Silent Hunter* is somewhat ahistorical and superhuman, all is not lost. Firstly, the v1.01 patch makes some token nods at toning down the destroyers and including some of their historical limitations. Secondly, the presence of a thermocline almost always means an easy way out: Just drop beneath it and creep away with impunity. And thirdly, destroyers are somewhat frail when they're on the receiving end of a torpedo. If there's only a single destroyer escorting a convoy, by all means take him out so you can pick off the rest of the ships at your leisure.



Barring any of the above circumstances, there are three things to do when the sonar pings start rattling inside your sub and you know you're busted: change heading, change depth, and sprint and drift. And be sure to do each of these things often.

Your heading is significant in reducing your sonar profile. As with the approach, your sub will be much more *visible* to sonar if you're at an angle to the destroyer. This is where the hydrophone reports come in handy. Ideally, you'll keep your tail pointed toward the bright red contact lines (shown in dark gray in the graphic) as you move away.

It's a good idea to go as deep as you can (125 percent of test depth is always a safe bet). This maximizes the amount of time between a depth charge's launch and its detonation, giving you more time to sprint away. However, as you're maneuvering, vary your depth within 50 feet or so to keep the guys upstairs guessing. If you're taking on water and repairs are a few hours off, opt for a shallower depth to reduce flooding. If the situation gets desperate and you begin an uncontrollable dive, wait for an opportune moment, and blow the tanks to move closer to the surface.

Most importantly, rig for silent running as soon as you reach your escape depth. Although this cuts your speed down to a languid creep, the reduced noise is invaluable. If you hear a depth charge hit the water after a destroyer passes overhead, immediately go to flank speed to move away. Once you've reached your maximum submerged speed, and rig for silent running again. Then, while you're coasting, take the opportunity to change your heading. You can turn more quickly at higher speeds, but be sure to manually control the rudder (computer-controlled turns reduce the rudder's angle as you get closer to the desired heading, taking longer than manual turns). Using this sprint and drift tactic, you can lose the destroyers in the interference caused by their own depth charges.

When you start to hear depth charges splashing without feeling the impact of the detonation, you can bet that your attackers have lost track of you. Stay quiet and work to minimize your sonar profile while increasing distance. Be sure to check the area with the periscope before surfacing. If you've escaped unharmed and still have time and torpedoes, consider catching up with the convoy for a second attack.

BACK AT THE ACADEMY

Finally, practice makes perfect. Most folks will bypass the historical missions, eager to advance their campaign careers. But many of these missions can serve as invaluable tutorials for certain aspects of submarine warfare.

- To experiment with different tactics for evading destroyers, start out against the pair of destroyers in Bud Gruner and the Agano.
- For a baptism by fire, take on four destroyers in Sink the Shinano.
- To practice slipping through destroyer screens without playing catch-up, there's a stationary fleet surrounded by escorts in S-38 in Lingayen Gulf.

- Halibut vs. the Ise is a quick way to check out the immense benefit of putting a thermocline between you and your pursuers.
- Sailfish vs. Chuyo will let you tinker around with a full radar suite and get used to tracking your victims in poor visibility conditions.
- Brush up on your ID skills by picking the juicy targets out of the crowd in Parche vs. Everybody.

There's a lot to do and learn in *Silent Hunter*; taking your time to make a thorough and leisurely tour of all the software's features will be quite rewarding.

12

U.S. Marine Fighters

Electronic Arts has combined the popular *U.S. Navy Fighters* with the *U.S. Marine Fighters* expansion disk and released it together on one CD-ROM as *U.S. Navy Fighters Gold*. This package also includes the latest patch that supersedes *U.S. Navy Fighters* version 1.1. While part of this patch fixes some bugs, it does also add some new features. Because *U.S. Navy Fighters* has been around for a while and much has been written about it already, this discussion will be limited to these new features and specifics of *U.S. Marine Fighters*.

A BOOT CAMP, OF SORTS

"Attention! All right you pond scum sucking maggots! Through this chapter's pages, I will be your instructor and will train you to become U.S. Marine fighters that will strike fear into the hearts of your enemies!"

CD-ROM

Check out the CD-ROM included in this book for the demo version of *U.S Navy Fighters*.

FRAME GAME

If you've played *U.S. Navy Fighters* before (or any of the latest generation of flight sims for that matter), the concept of frame rate will be nothing new to you. Since *U.S. Marine Fighters* is an add-on (based on the same engine), you can

expect comparable frame rates—with all of the detail turned on—and it will bring even the fastest processors made down to their knees.

While frame rates are subjective (some people claim smooth as silk frame rates with a P90 at the highest resolution with all details on), with *U.S. Navy Fighters* and *U.S. Marine Fighters* you can now press Ctrl+F and the current frame rate will be displayed, as shown in Figure 12.1. A frame rate of 10 per second is about as low as you should get, and 8 frames per second should be the very bottom limit. You may have a higher tolerance, but the deciding factor should be aircraft response. If you find yourself over-controlling your aircraft, chances are your frame rate is too low.

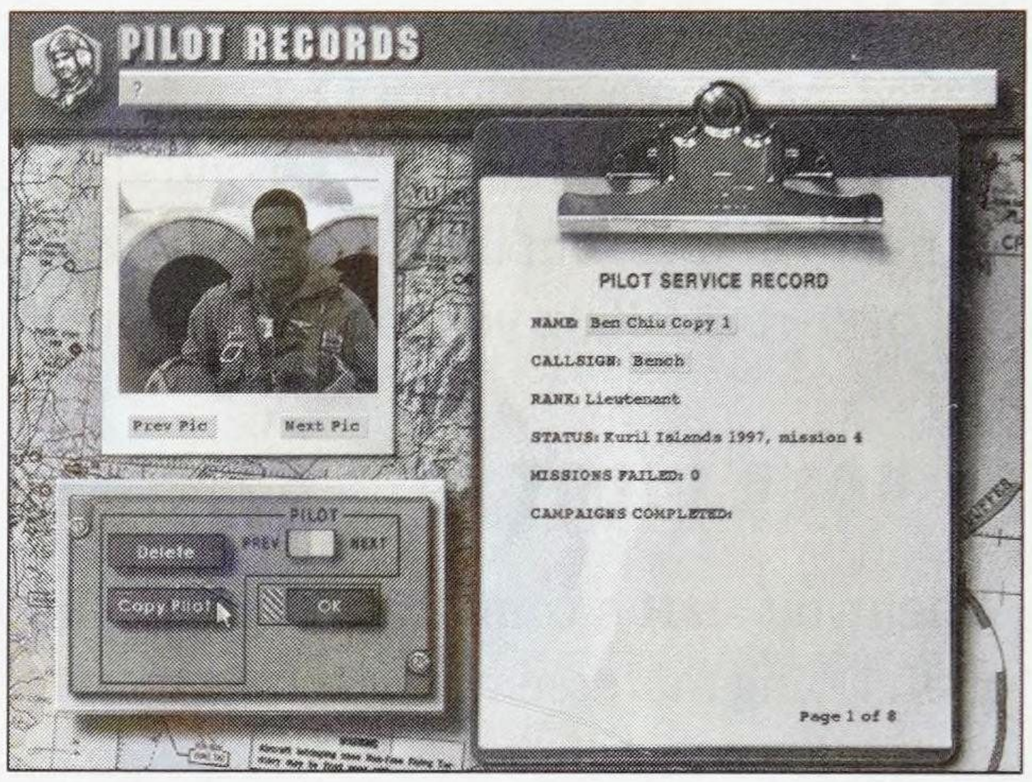
COPY YOUR PILOT

When you start a campaign, the most important thing to do is make a copy of your pilot. Doing this essentially acts as making a backup of your pilot. This is very important to do so that if you exit a campaign by mistake after your pilot augers in, you can restore where you left off. Just remember to copy and backup your pilot often.

FIGURE 12.1: Pressing Ctrl+F displays the current frame rate.

Pick a Plane

After accepting and reviewing a mission, you'll next be asked to select an airplane. There are three things to keep in mind here. First, the airplane recommended in the briefing is always a good choice. Second, you don't always need to choose an aircraft that is 100-percent operational. And finally, *U.S. Marine Fighters* adds four new aircraft—AV-8B Harrier II, Sea Harrier, Yak-141, and the AC-130U—and the Kurile Islands campaign. While you can fly these new *U.S. Marine Fighters* aircraft in the Ukraine theater and *U.S. Navy Fighters* aircraft in Kurile theater, by doing so you won't earn any medals or promotions.



CHANCE ORDNANCE

Read your mission briefing thoroughly. The default ordnance loads do not match the recommended loads many times, as shown in Figure 12.2. Also, a few of the missions don't require everything that is recommended. While studying the mission briefing and knowing your weapons will help a lot, there is really no way to know exactly what you'll need on the mission until you fly it. Until you do actually fly it, you can only take along your best guess as to what you'll need. The main thing to be worried about is being caught short of the proper weapons halfway through the mission. If you're in doubt, take it along with you. You can always drop it off somewhere (hopefully on the enemy) if you need to.

U.S. Navy Fighters now offers a large window option. No, it isn't the next incarnation of a Microsoft operating system. In the higher resolution modes, the view windows became pretty small. With the new option checked, it'll make larger, more legible windows.

RADAR WARNING RECEIVER

Some of the symbols on the Radar Warning Receiver (RWR) have changed to provide more information. A diamond indicates aircraft using radar, a big square indicates

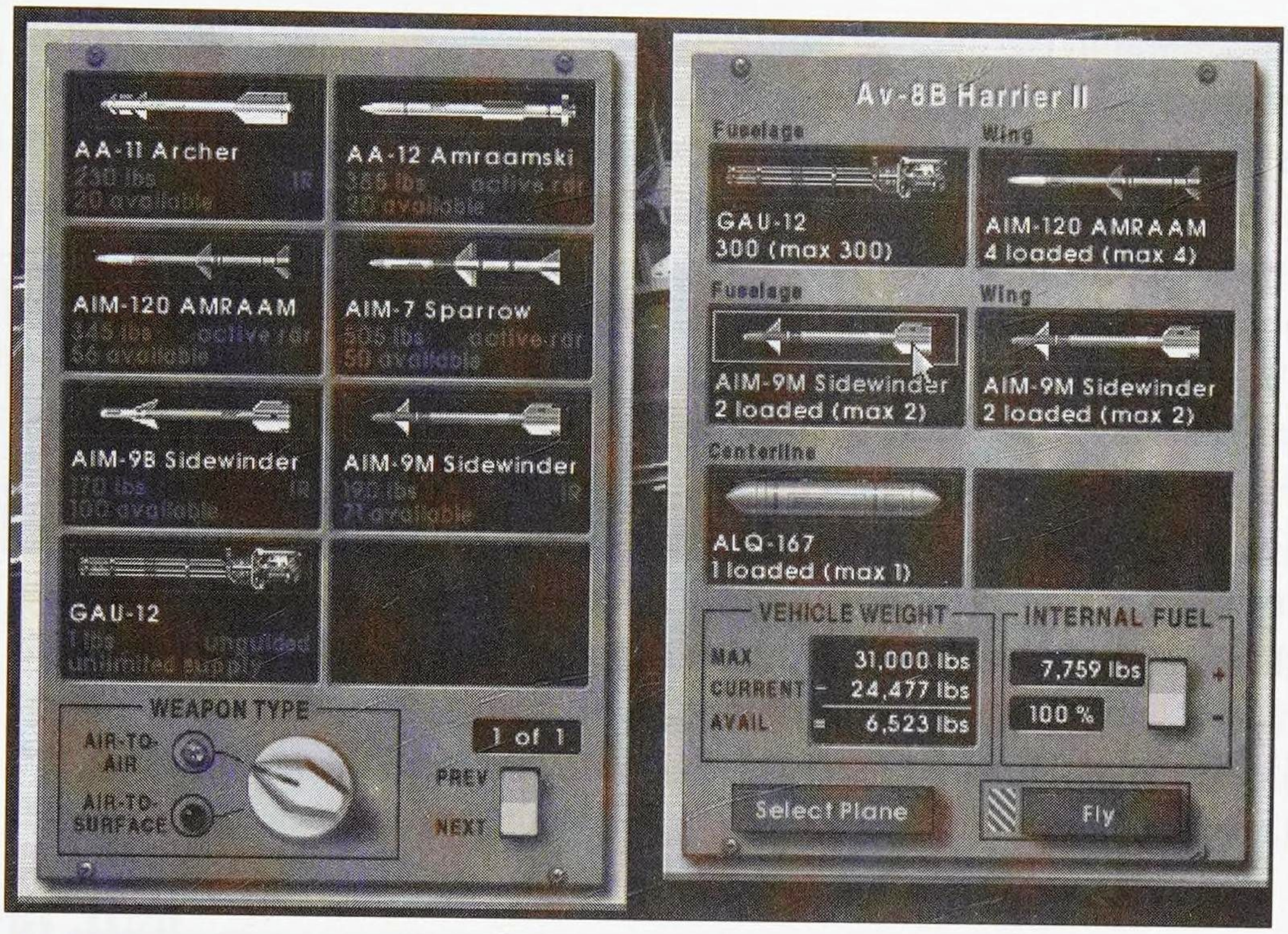


FIGURE 12.2: Always check the default ordnance load as it doesn't always contain what you'll need.

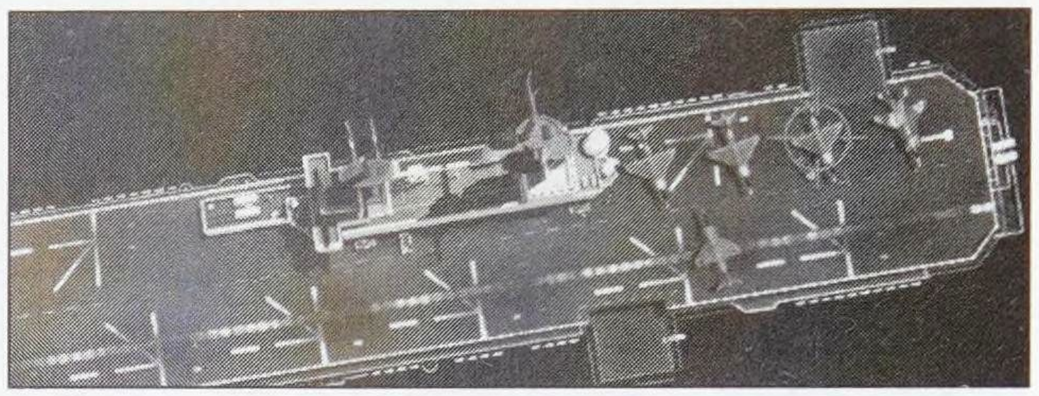
ground-based radar and small squares indicate missile. If any of these are lit up, they're tracking you. The one exception is with missiles you have fired. They'll light up for as long as they're tracking your target. You can distinguish them from incoming missiles by the direction they're traveling. If they're flying toward the center of the RWR, do something about it. You're defensive!

There isn't any doubt that you will get shot down or fail a mission some time. It's just a fact of flight sims. However, *U.S. Navy Fighters* allows you to replay these missions. When you do, pay particular attention to the debriefing as it provides precious clues on how to complete the mission. Just remember, if your pilot gets killed, choose to replay the mission again even if you want to quit for the day. Otherwise your pilot will be killed for good. All is not lost though, if you remembered to copy your pilot as was mentioned earlier.

IF YOU'RE NOT CHEATING YOU'RE NOT TRYING

U.S. Navy Fighters will not allow you to earn medals or promotions if you use the cheater target window (Shift+4). While some argue that the target window makes up

for the lack of AWACs and real-life eye resolution, most pilots (and obviously *U.S. Navy Fighters* designers) consider this cheating. Well, one way to get around this limitation is to make maximum use of your alter ego's superior eyesight. Designate the target in question and command your wingman to attack it, as shown in Figure 12.3. If it's an enemy, your message displayed to him will indicate what the exact target is even though you and it couldn't possibly see it.



The best part is that you'll still be eligible for medals and promotions! This method won't provide you with all of the information that the target window would such as its activity, skill, goal, and damage, but it is very useful for figuring out who your biggest threats are and who the bombers are. Don't worry if you designate a friendly target by mistake. Your wingman knows better than to attack friendlies.

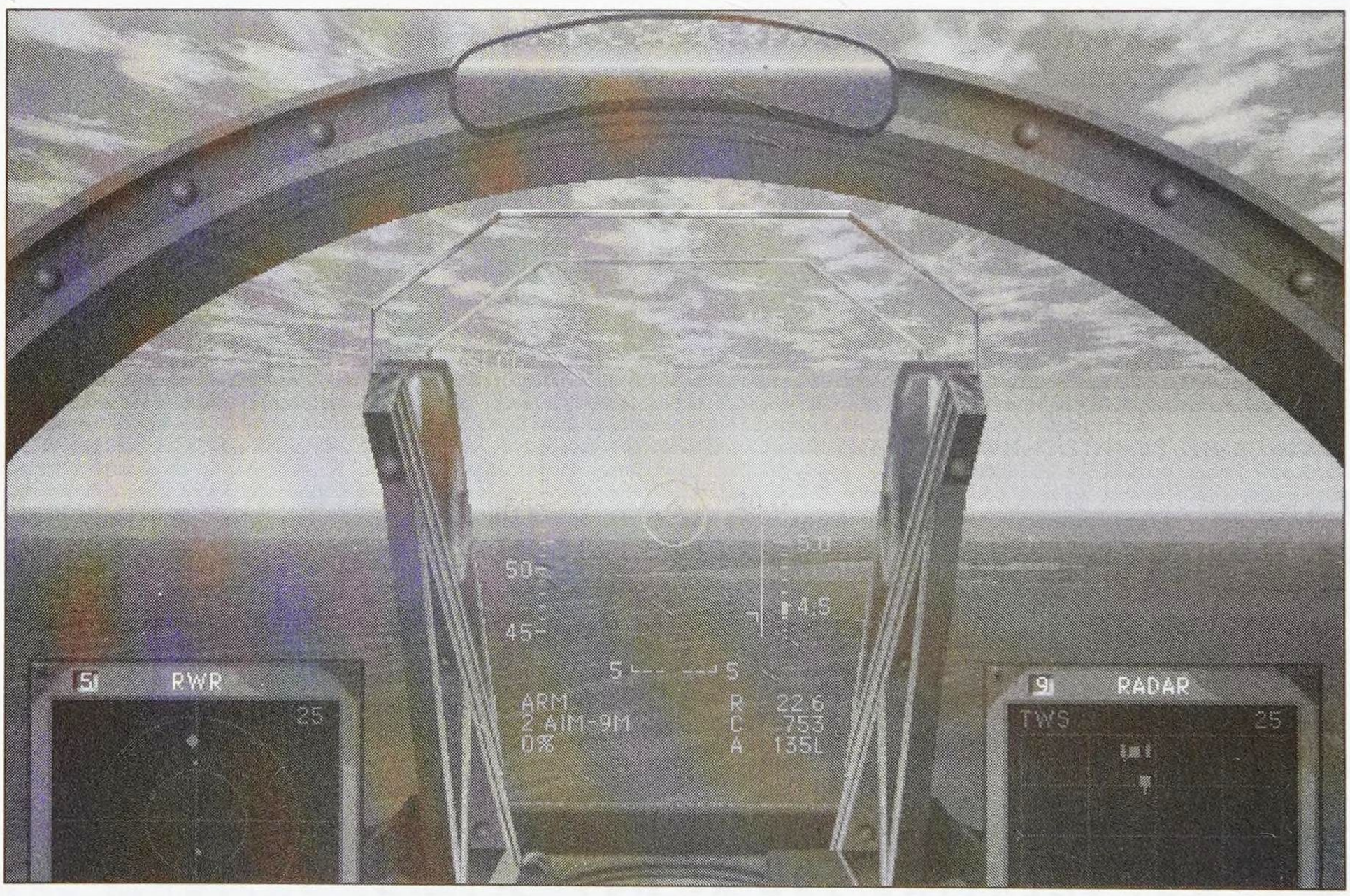


FIGURE 12.3: Tell your wingman to attack a target, and your alter ego will be able to tell what the target is.

If you turn down terrain detail to minimum, all of the mountains will disappear. This makes some missions much easier. However, while it makes targets easier to find, it also makes you an easier target for SAMS and AAA, so beware.

VERTICAL TAKE OFF AND LANDING

U.S. Marine Fighters contains Vertical Take Off and Landing (VTOL) aircraft. The manual provides enough information to learn to fly them, however there are a couple of things you should know. Number one is you cannot do vertical take-offs with a fully loaded aircraft. It just doesn't have the thrust. Number two is that VTOL aircraft aren't super fast and at first may not seem to turn very well either. You can decrease your turning radius if you use your vector nozzles to your advantage while turning. However, don't try using more than about -60 degrees or you'll end up bleeding off too much speed. Finally, when landing, you cannot spin a VTOL aircraft if you have at least -45 degrees of vector angle.

AC-130U

The AC-130U is basically a cargo plane with a few big guns on it. What's kind of odd about it is that the guns are all aiming at a 45-degree angle off the port side of the fuselage. It was designed so you could circle around a ground target in a counter-clockwise direction and shoot at it. Well, as you can imagine, this configuration doesn't make it very useful for air-to-air combat. However, once you know where it shoots from and where it's aiming, it is usable. From the pilot's seat, the guns fire at a 10 o'clock angle. Fly along the starboard side of the target aircraft and fire away. Don't forget to pray also as you'll need the help.

MISCELLANY

Another important addition to *U.S. Navy Fighters* is the ; (semi-colon) key. This sets your target designator to nothing. While you have the option to manually designate targets using a mouse (or Thrustmaster TQS trackball), reaching for your mouse isn't always convenient. (Although the TQS trackball is very convenient, it's tough to do in a knife fight.) The target-nothing key will let you change target designation so you can designate another specific target, even if it doesn't show up on your radar. Rather than cycle through the current targets, you now have the option to first target nothing, then

designate the new target using the target visible object closest to the center of screen apostrophe key (’). This option is more efficient.

U.S. Marine Fighters’ Kurile campaign is definitely tougher than the Ukraine, but hopefully you now have an edge. Now get out there and make me proud, but first . . . “drop and give me 20, private!” “One, two, three, four, I love the Marine Corps!”

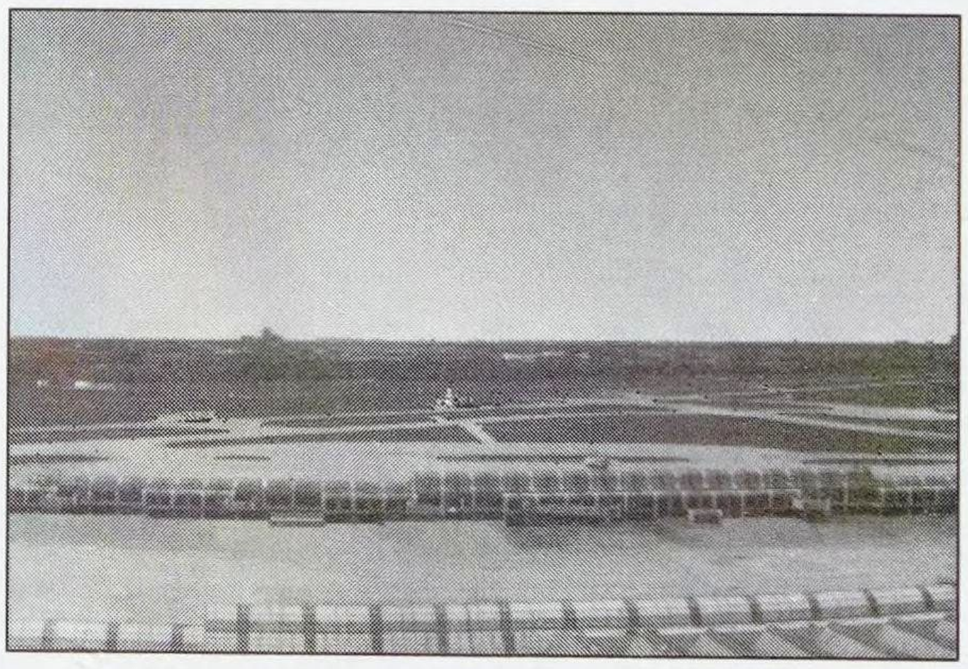
13

Tower

Tower is a newly released airport control-tower simulation from BAO. Based on FAA and Transport Canada's professional air traffic controller training simulation software, it puts you in the hot seat controlling takeoffs, departures, approaches, and landings. Three different airports are available: Chicago O'Hare, Washington National, and the fictional Canyon Field.

TOWER TO PILOT . . .

You'll wear three hats in *Tower,* doing the job of the Ground Controller, Local Controller, and Flight Data Specialist. When the traffic flow rate is high, you'll be as busy as a one-armed paper hanger. Of course, there are a few strategies and techniques that will help you learn the trade.



PROPER PRIOR PREPARATION

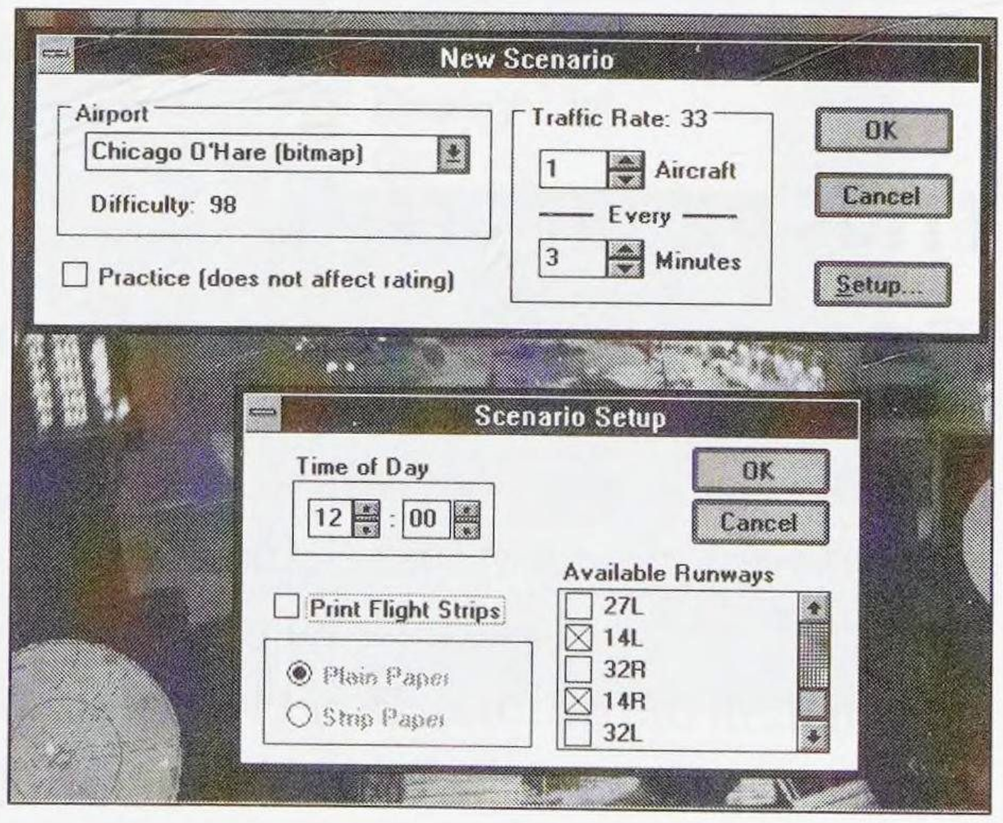
While most of us like to load a new game and dive right in, the technical nature of this one will leave you wondering what's happening. There are no monsters to blast into atoms here, just continual careful planning and constant readjustment. If you don't read at least some of the manual first, you will be totally bewildered.

The most important aspect of the game is communicating with the aircraft. Aviation has its own language. If you want to join the club, you've got to talk the talk and know what you're saying. So the first tip is to read the Glossary of ATC Terminology in the back of the book. Then you should read Chapter 4 of the glossary again before you jump in the game. It's short, and it won't take long. These are the actual commands you can give the pilots in the simulation. If you don't understand what the pilot is going to do when you issue a particular command, go back to the glossary and read the definition. You're not controlling anything if you don't know what you're saying!

Chapter 5 of the glossary is also very important because it describes the overall game plan. It gives basic explanations of how arrivals and departures work and your part in making them succeed. There is a sample scenario showing the sequence of routine commands and responses and some other general information. It finishes with a description of the sample airports. Don't let them scare you; Chicago O'Hare is not the disaster they portray. O'Hare has lots of runways available, and if you start with a slow traffic flow it's not bad at all!

ON WITH THE SHOW!

Once you've done the reading and comprehending, leap right into *Tower*. Using the file menu, select Controller and create your controller persona. Then select New Scenario from the file menu. Don't worry about using practice; make it the real thing. The trick here is to go ahead and select Chicago O'Hare (Figure 13.1) for its high point rating, but set the traffic at a rate you can handle. If you have a good understanding of how an airport works and are familiar with the terminology, you can easily handle one aircraft every 3 or 4 minutes. If you don't have an aviation background and the terminology is not second nature to you, double that time. You're going to be looking a lot of stuff up in the book!



When you go on to the Setup menu, selecting your available runways needs some careful thought. Look at Chicago's airport diagram. The long runway pair is 14R and 14L. If you make these two the active runways, approach will vector all aircraft to them. By picking the long runways, you won't have the problem of a large aircraft trying to land on a short runway. You'll

FIGURE 13.1: O'Hare at night

reduce your workload ahead of time by not having to reassign large aircraft to a different runway. You can still switch smaller aircraft to short runways if things get busy. Do not select the Print Flight Strips option. Every time the sim prints a flight strip, it pauses the action; after a bit it will drive you nuts. If you have a very fast computer and printer this interruption may not be such a problem.

SETTING UP THE OFFICE

First, tear out the "Tower Keystroke Template" from the back of the book and prop it up near your keyboard. This lays out all your commands for easy reference. Next, open the manual to page 66, which contains the Chicago O'Hare radar map showing the departure and arrival fixes. This chart needs some additions. Go into the README file and look at the O'Hare Nav Point list. Draw these points in around the perimeter of the chart in the manual. Don't worry about distance, only the bearing. Keep this where you can see it as well. When you get a flight strip on an aircraft it will show his associated fix. You can easily see where he wants to go or where he is coming from and assign him the most convenient runway.

Begin the scenario and you'll find yourself in the tower cab at O'Hare. While the digitized view is great and very realistic, you're going to have to clutter up the windows to control this operation (see Figure 13.2). The ASDE screen shows you where the traffic is on the ground and gives a runway and taxi layout. Select it and size the window down until it's just readable. Do the same with the BRITE display that shows you airborne traffic within 50 miles of the airport. Select the Arrival and Departure Flight Strip displays and size them down until you only see the aircraft data.

Reference the example on Page 39 of the manual. Stack the radar displays on the side of the cab and align the Flight Strips along the bottom. You will have a large viewing window. The advantage here is using the tracking view. Select tracking view from the 3D View menu and any selected aircraft will automatically center. As it moves, the view will follow it. To select the plane you want to see, simply click on its Flight Strip or data tag in one of the radar scopes. This is particularly helpful in controlling aircraft on the ground.

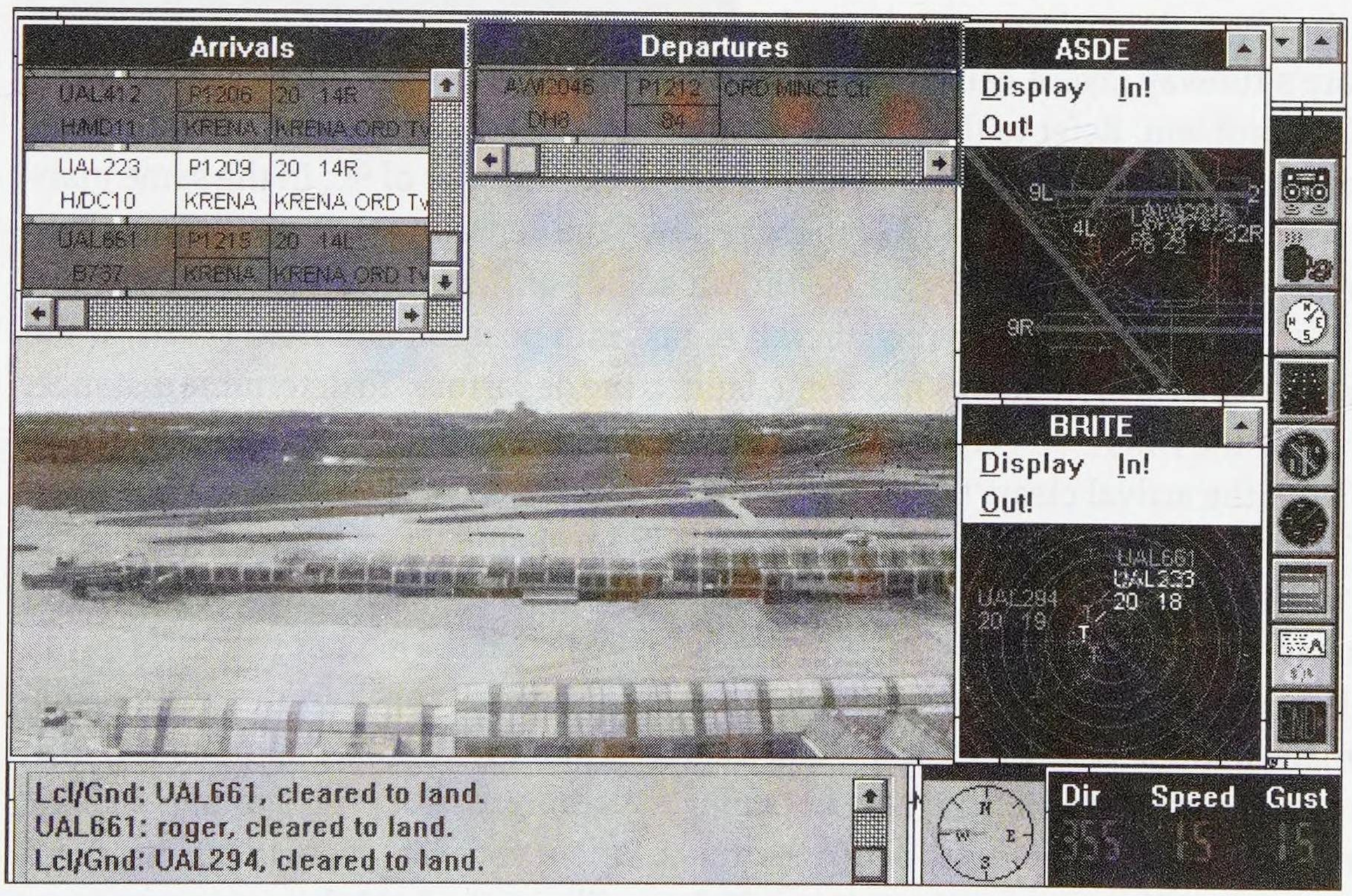
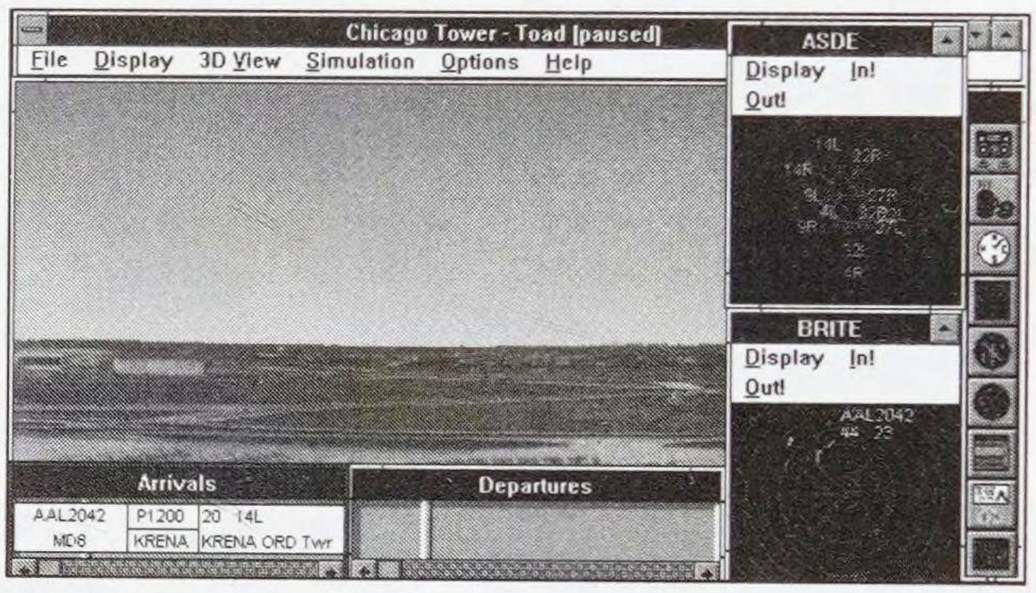


FIGURE 13.2: Use of the Strip windows makes printing Flight Strips unnecessary.

MAKING THE MOST OF YOUR FACILITIES

Now you're ready to take control. It pays to have a general plan once the aircraft start moving. In this case, we have made 14L and 14R the active runways for landing. Try to land all the aircraft on one of these two. Assign aircraft arriving from the North and East to 14L and send those from the South and West to 14R. This will keep aircraft from mixing together right over the airport.

The only exception will be a B-747, which cannot land on 14L. The 747 requires more than 10,000 feet of runway in this simulation. Launch aircraft off 9L and 9R. A glance at the Departure Flight Strip will show their first fix. Check the BRITE diagram for the navigational fixes around O'Hare. If they need to go north or east, assign them 9L; south or westbound aircraft should depart on 9R.



Landing aircraft generally have priority over departing aircraft, and O'Hare's runway layout can cause you a minor problem. Refer to the runway diagram for O'Hare. You see that aircraft landing on 14L may interfere with an aircraft at the departure end of 9L. In the same manner, l4R crosses 9R about a third of the way down the departure runway. It won't help your career if arriving and departing aircraft collide at these intersections. The solution is to instruct your departing aircraft to taxi into position and hold (/TH). If the aircraft on final is more than 5 miles out, launch the departure. To determine distance, just zoom the BRITE screen in and check. If he's closer than 5 miles, hold the departure until the arrival clears the runway.

Taxiing aircraft may cause the same problem. An aircraft taxiing out to 9R will cross 14R unless you give him the hold short (/HS) command. As a rule, give the hold short command immediately after you give permission to taxi, if the aircraft will cross any of the landing runways. When he stops at the intersection, check to make sure final approach and the runway are clear, and then give him the continue command (/TU). The same procedure applies to aircraft taxiing to parking. Once on the ground, arriving aircraft no longer have priority over departures. Before you clear them to taxi in, check to see if they will cross an active runway. If they will, use the hold short command.

When aircraft begin to bunch up in the air, you have a problem. On the ground you can simply give one or two of them the hold your position command (/HY) until you

get proper spacing. It's not so simple in the air. The simulation does not have the capability to request a speed adjustment from the pilots. This solution is a favorite of approach and tower controllers but is not available to you. Your next best tool is the turn (flying vectors). If an aircraft is coming in to the landing runway a little too quickly, give him a 360-degree turn. Turn him away from any other nearby aircraft using the make_turn command (M_3). Fill in the blank with either L or R for the desired direction. That turn should give you about four minutes spacing. If you need more than that when things are too hectic, give him a 180-degree turn and get back to him later!

These tips should get you well on your way to earning your first perks. Just remember to start with the low traffic flow rate and use the pause button when you need a break. This is an engrossing game; enjoy it!

Flight Simulator Flight Shop

At first glance the task of designing your own aircraft may appear to be quite formidable, but you just need the right attitude. *Flight Simulator Flight Shop* from BAO includes a Flight Dynamics Editor to allow you to tune the aircraft you produce.

AN AIRPLANE HOBBY SHOP ON A DISK

You say you always wanted to be an aeronautical engineer but differential equations finally forced you to switch your major to basket weaving? You've always wondered what you could have created if you had only mastered the math? Well, wonder no more because BAO Publishing has come to your rescue. With the release of *Flight Simulator Flight Shop*, BAO has placed an aircraft design factory at your service. You'll be able to design, build, paint, and customize the aircraft of your dreams and test fly it using Microsoft's *Flight Simulator* (version 5 or 5.1).

I CAN'T READ THIS MANUAL!

At first glance, the program's manual can be quite intimidating for a wanna-be aero engineer. Chapter 2 in the manual, the designer's guide, runs more than 70 pages alone. There is a tutorial that will slowly lead you by the hand through the design and building of a paper airplane. BAO even added *workshops* that will likewise hone your skills. Don't worry!

This program is not so detailed that it is impossible to use, and the instructions are clear and simple. If you are a *Flight Simulator 5.1* aficionado, you're motto is probably "alone, unarmed, and unafraid" anyway. Just dive right in and learn by doing.

The very best advice given in the program's manual is to round up the necessary references before you start. It will save you a lot of running around searching for dimensions between building each part. You'll find it easier to learn this program if you try to recreate an existing design rather than invent a new aerospace vehicle.

So decide what you want to build, gather some photos of the aircraft from various angles, find some drawings or blueprints that include dimension information, and secure some basic performance data. If you can't find dimension information, get a good ruler and hope the drawings are to scale! In addition, you need the right "just do it" attitude. The program design functions are based on tenths. For example, you make a part 2.5 feet long. Most blueprints are going to list dimensions in feet and inches. Don't let the minor details get you down. Round off the foot dimension to something close and press on. Otherwise, you will make it way harder than it needs to be for no noticeable result at the end of the project.

The example used in this chapter for this project is a Fairchild PT-19. It was one of the workhorse trainers of World War II; more than 12,000 were built, used mainly in the United States and Canada for primary pilot training. Its flying characteristics are superb for training new pilots. More than 200 are still on the FAA registry, with about 100 of those in flyable condition. Reference material is readily at hand. Many of the original Army manuals are available. The airplane Parts Catalog with its exploded drawings of even the smallest assemblies is a great help. The airplane Structural Repair Manual, Maintenance Manual, and the Assembly Manual also provide dimensions, pictures, and diagrams. Performance specifications are in the Pilot's Operating Manual. Thus, the PT-19 seems to be the perfect choice for experimentation with *Flight Simulator Flight Shop*.

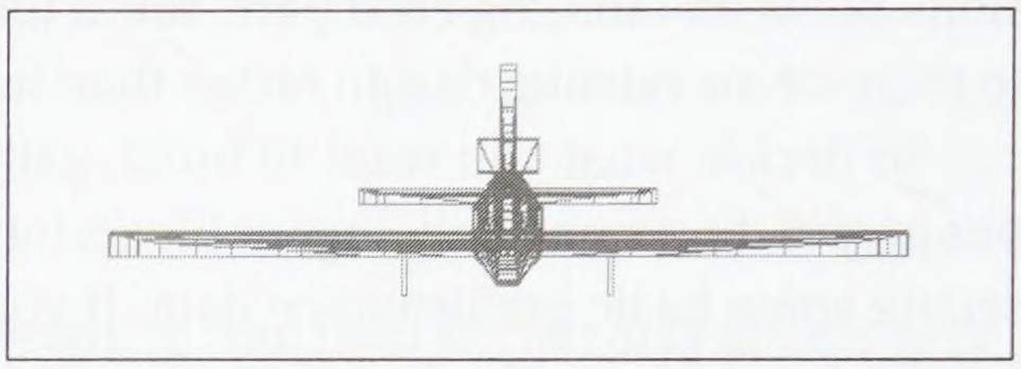
TIP

If you are in search of such references, check the "Books" section of Trade-A-Plane. It's published three times a month and is available at major newsstands. Manuals are for sale for both military and civilian aircraft within its pages.

EVERYBODY INTO THE POOL

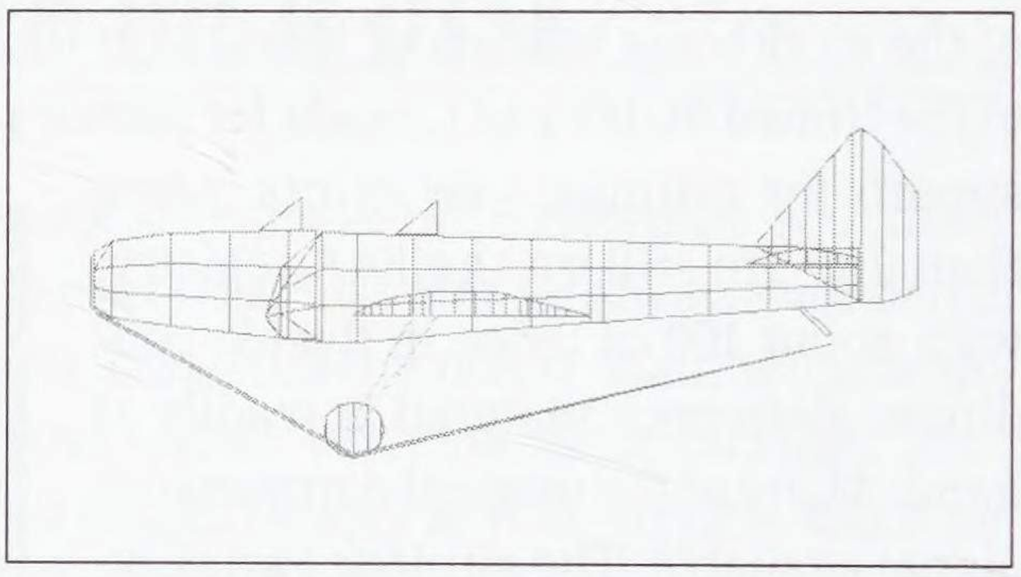
Use the "learn by doing" approach and turn to page 19 of the manual, the tutorial on how to design and build a paper airplane. If it works for paper, it should work for a PT or anything else, and the result will be much more fun to fly. The step-by-step approach

is perfect; simply follow the directions for creating your project directory and then change to it. Keep right on going and set up the blueprint screen as they suggest. Now, when it is time to draw the actual blueprint for the fuselage, there is an important shortcut to the procedure.



Have your proposed blueprint already sketched out on a piece of graph paper. Use your reference materials and plot each point in an outline of the shape you intend to create. This may seem a little unnecessary, but it will ultimately save you time. The program plots reference points in a sequential manner.

Unfortunately, it won't allow you to go back and adjust one in the middle of the blueprint without erasing all the points that followed the incorrect one. This is a pain, so make sure you plot them correctly the first time; use your graph. Prepare the side view first. Remember, no one is going to the moon in this thing, so round off the measurements to the nearest 6" (.5 inches in *Flight Simulator Flight Shop* style) and get on with it. You can be precise to the last millimeter in later projects! You won't be able to connect the last point with the first point to close the design, but don't worry about it. The program will take care of that; just put it as close as you can get it.



Next build the top view by drawing it in reference to the side view. Select a new part and reference it to your previously saved side view. Line up the parts carefully; switch between side and top views to make sure they join correctly where angles change. Definitely use the Symmetry mode from the Create menu as the manual suggests. It allows you to draw one half of the view while the program *mirrors* the other half. It's a great time saver.

One minor characteristic of parts building can be annoying. You are limited to 30 reference point entries when you design a part. On long, mostly straight parts this is not a factor. When you start trying to draw curved surfaces it may limit you, especially if you use the Symmetry Mode. For example, if you want a wing with nicely curved wingtips you will have to closely space many points as you go around the wingtip to get that smooth look. But in Symmetry mode, each point is being duplicated on the

other side of the axis; in effect, you are limited to 15 points. To get around this problem, either use points sparingly except at the wingtip, or don't use Symmetry mode. Just build one wing. Later, the Assembly Line will allow you to add a mirror image of the one you actually create to the opposite side of the aircraft.

BULKING UP

After you've built the top and side views of the fuselage and saved them, you can move on to the step that will make these line drawings begin to resemble an aircraft. Installation of the bulkheads appears difficult when first viewed, but it is one of the easiest procedures. Once you are in Structures, select both of the parts you just built. When the two parts are overlaid they look like totally unrelated pieces! Don't worry. Believe!

From the Bulkhead Toolbox select the type of bulkhead you want. These shapes will define how the exterior of your aircraft looks. For a PT-19, the Flat Octagon was the closest to the original. Once again, placement proceeds progressively across the screen form one side to the other. If you make an error, you will have to erase all bulkheads back to the bad one to change it. Generally, you will want to place a bulkhead at any point where an angle change occurs in either the side or top view. For long straight stretches, space bulkheads evenly through the structure about a foot apart. As you approach ting areas, such as the trailing edge of a wing, you may not be able to place a bulkhead without causing a lump in the profile. If the area is less than 8 inches thick, it won't need a bulkhead. The Structures screen also has a limitation on the number of bulkheads you can place. The program will not accept more than 20 and will display a message telling you to rework the design.

When you think you have it right, manufacture it and save it as the book suggests.

ASSEMBLY LINE PRODUCTION

Repeat the previous parts and structure building process until you have all the basic parts necessary for the aircraft. The PT-19 required a nose cowl, fuselage, wing, horizontal stabilizer, and vertical stabilizer to resemble an aircraft. Follow the same assembly procedure that the manual specifies for the paper airplane and your aircraft will be ready to test fly in no time!

THE CREATION CONTINUES

As you can see, almost as soon as *Flight Simulator Flight Shop* arrived on the market, you could put a Fairchild PT-19 into production. Now let's press on by adjusting the original design, adding some detail features, and getting it painted.

NOT QUITE LIKE THE PROTOTYPE!

In the low-stress approach we took to building our airplane, dimensions were rounded off to the nearest half a foot. The resulting product looked quite a bit like a basic PT-19 without the small parts attached. After flying it around a bit and looking at it from various angles, it appeared the forward fuselage was a little too shallow. So back to the drawing board! Changes to the design are easy to make. If you plan major changes, however, it might be easier just to create a new part. Just give the part name a new suffix, for example "S_fuse2.afp."

Go back to Planning & Logistics and change the project directory to the aircraft you want to alter. Click on the Parts building and select Open Part For Rework from the menu. The side view of the fuselage was wrong, so that was the target piece. Click on the Rework menu on the tool bar. You have two choices here; you can select On Screen or Point Editor. On Screen will show the point being edited in a small circle; you can use the mouse to move the point as required to get the shape you desire. Use the right and left arrow keys to move forward or backward to another point. This method is fast and simple, but may not give the precision you need to get the part just right. You'll have to use the coordinates in the draw box as your references. It can be a little tedious to get the tenth's value where you want it with a mouse.

GET THE POINT?

For precise work, use the Point Editor. When you select it from the Rework menu the Point Editor box appears in the lower right corner of the screen, as shown in Figure 14.1. You can modify, insert, or delete a point by highlighting it and clicking the appropriate button.

Again, a small circle will surround the point on the blueprint when you highlight its coordinates. You can type in the exact values you want for your point, press Enter, and the editor will instantly adjust the point in the blueprint. This function will not

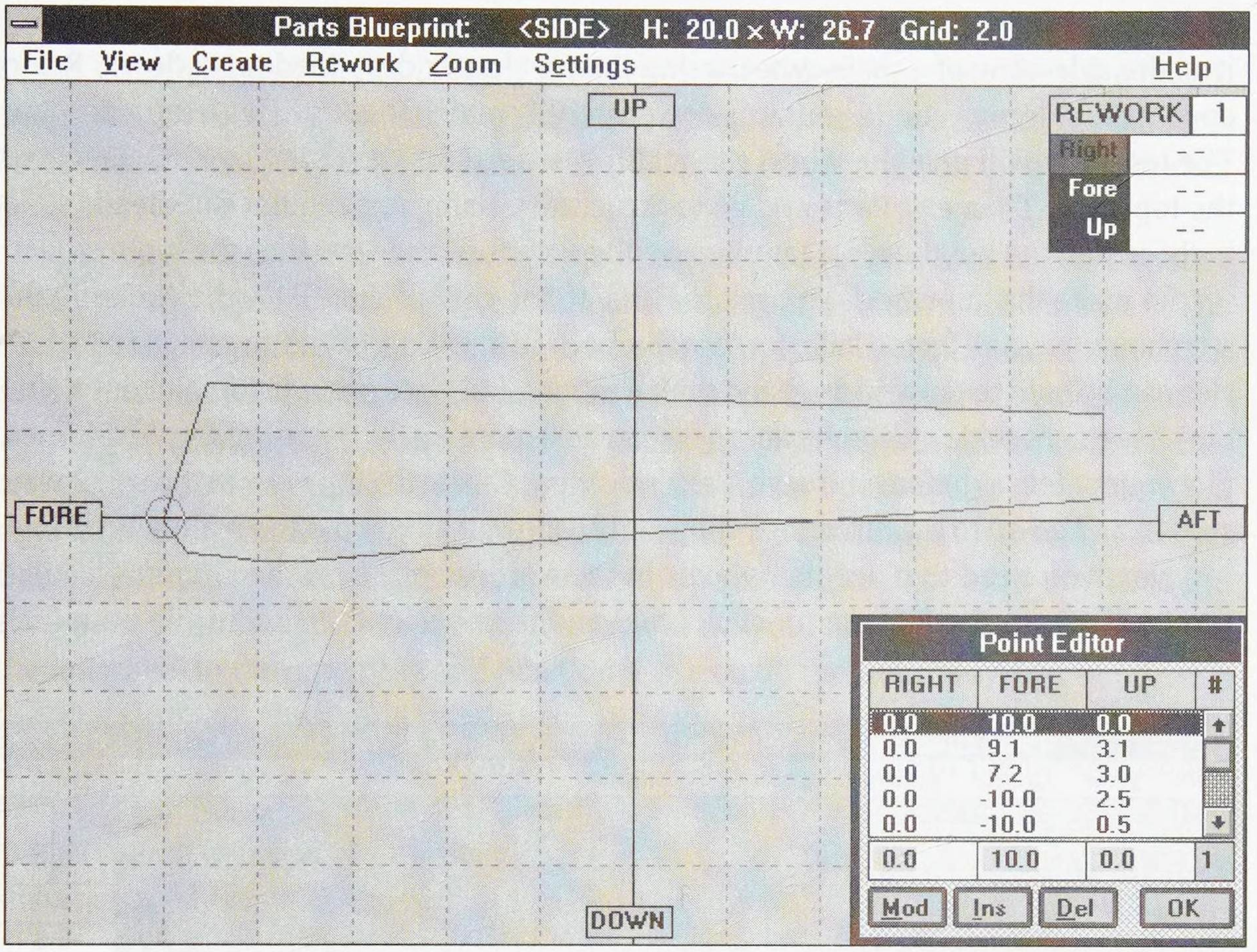


FIGURE 14.1: Call up the Point Editor from the Rework menu to hammer out the finer details.

edit points symmetrically if you built the part using the Symmetry option. Be sure to look at the part from all viewing angles before you save it, or you'll be coming back to rework it again.

ADD THE LANDING GEAR

Fortunately, the landing gear on a PT-19 is extremely simple and not unlike the example used in the *Flight Simulator Flight Shop* manual for the paper airplane. Once again, you can simply follow the basic outline in the book. You'll be creating two main gear wheels and a tailwheel and then main and tailwheel struts.

Start the Aircraft Factory, enter the Parts building and select Import Parts From Storehouse. Select Circle12.afp and you will get a 12-pointed circle on the screen that will quickly make a nice main wheel. With the circle on the screen, select Rework from the toolbar and select Magnify from the menu. You can use Magnify to scale the wheel up

or down until the size is correct for your particular aircraft. Once you have it sized, save it as the side view of a main wheel using the previously described procedures. Referencing the side view, build your top view; carefully match the edges with the side view. The top view will give the wheel the width you need for the right size tire. Save it as the top view. Then exit Parts and go to Structures. Using rectangular bulkheads sparingly, install the bulkheads, Manufacture the structure and save it as the main wheel.

To make the tail wheel, go back to Parts. In the case of the PT-19, the circles in the storehouse were all far too large for the tailwheel, so it was necessary to create a part. Circles can be hard to draw in freehand with a mouse, but once again if you plot out a simple 12 segment circle on graph paper, you can do it more easily. Using the graphed values, plot your points as before and save it as a side view. Create the top view in the usual way, save it, and go on to the Structures shop and produce it as you did the main wheels.

Next you need to place the wheels in their proper place on the aircraft (see Figure 14.2). From the File menu, click Load and then select the aircraft file on which

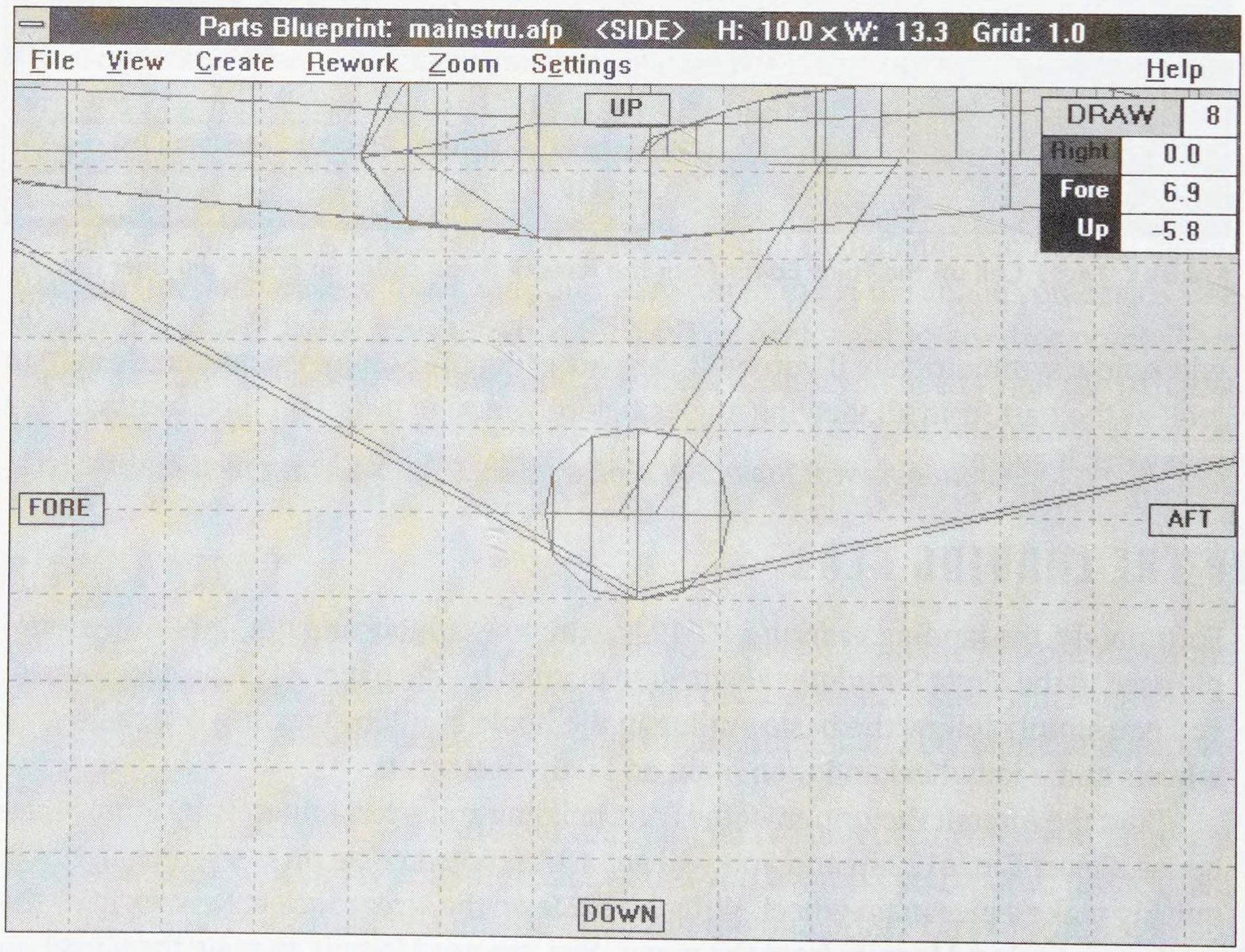


FIGURE 14.2: The wheels have to be adjusted to the correct position.

you're working. Take the Shuttle bus to the Paint Shop, and use the Add to Assembly to put the wheel assemblies into the production list. Select Structure from the menu, and highlight your main wheel file. You'll be adding both main wheels at one time just by checking the Add Left-Right Pair option. Click on Select and you'll be back to your parts list.

Double-click on the wheel assembly to bring up the Specifications Sheet. The Spec Sheet will allow you to set display conditions for the gear, as shown in Figure 14.3. The PT-19 has fixed landing gear; therefore, choose Always as the display condition. Click on OK and you will be back at the parts list with the wheel assembly line highlighted.

Take the Shuttle Bus to the Assembly Blueprint. The wheels will be in the incorrect location. Select the front view. Simply put the cursor over a wheel, hold down the right mouse button, and drag it to the desired location. Do the same for the other wheel. Use the coordinates in the box to make sure the position is correct. Now switch to the side view, and adjust the wheels if necessary. Make your final check in top view. Add the tailwheel to the assembly and position it in exactly the same way.

The struts for the main landing gear and tailwheel are made just a bit differently than usual. Just go to the Parts building and make a new part in the desired shape using the side view. The difference is that you will save it as a Standard application instead of a side view. This just means the part will appear in the final product as shown. It will still be fabricated as a solid. Go through the standard routine of adding

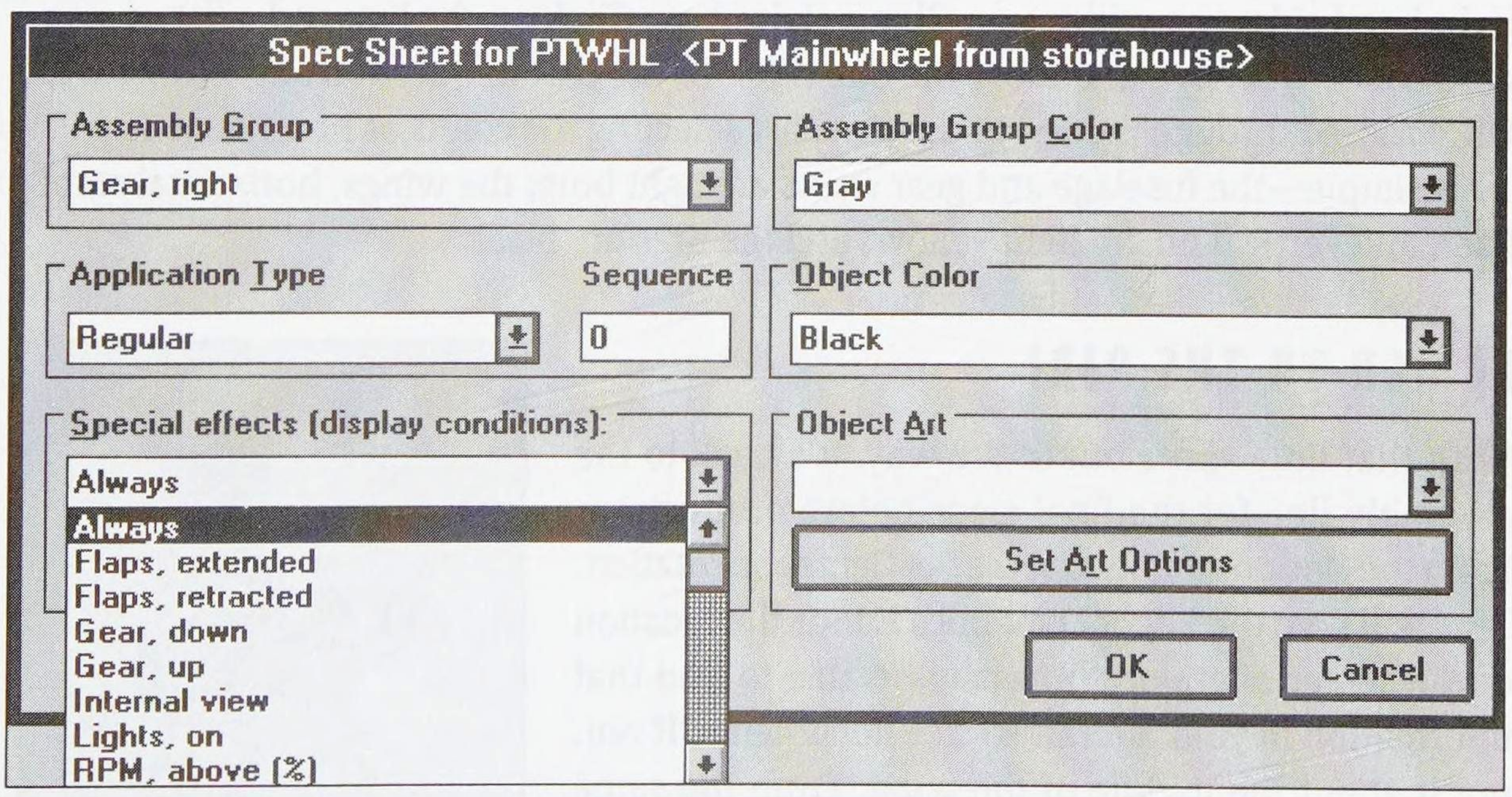


FIGURE 14.3: Use the Spec Sheet to tailor fit your plane.

it to the assembly list, and position it on the blue print by dragging it with the mouse. This is much faster than fiddling with the point editor, and the results are just as satisfactory for a quick build job.

Get Those Bugs Out of My Teeth!

While open cockpit flying is fun, it can literally be too much of a blast without a windscreen in front of your face. We'll add the two windscreens to deflect the bugs. Head back to the Parts Shop and create a new part, the windscreen. Use the standard procedure of building a top and side view and then going to Structures, installing bulkheads and Manufacturing it. Go to the Assembly building and add it to the Assembly List two times, one for each cockpit. Go to the Blueprint screen and position the windscreens by dragging with the right mouse button. Be sure to check the position using all three viewing angles.

OFF TO THE PAINT SHOP

No USAAF trainers were delivered in the attractive blue and yellow colors after May 30, 1942. So we could just paint the whole airplane silver gray and be on our way. However, the blue and yellow combination is much better looking, so that's the choice!

The quick way to color your airplane is to go back to the Assembly list and double-click on each entry in the list. This brings up the Specifications Sheet again. On the right hand side, you will see an Object Color box. Click on the box and a list of standard colors will appear. Choose the one right for the part in question and exit with an OK. Proceed through the rest of the parts list selecting the colors as necessary. The PT-19 is simple—the fuselage and gear struts are light blue; the wings, horizontal stabilizer, and vertical fin are light yellow; and the tires are black.

TAKE HER TO THE AIR!

With that little chore out of the way, it's back to the assembly line for the final steps before production. From the Options menu, choose Set Center of Rotation. This will give the Flight Dynamics Editor the location of the center of gravity. You may be able to find that information in your aircraft source documents. If not, put it about the middle of the wing. From the same

menu, select Set View Center in the expected location of the pilot's eyes when he's sitting in the cockpit. Again from Options, click on Assign Flight Dynamics and select From Template File. A PT uses the Single Engine Prop Template. Now produce your aircraft and take it for a test flight!

C

Fighter Duel

Your heart is thumping a mile a minute. How good is your opponent going to be? The blank computer screen suddenly bursts into a realistic, shaking instrument panel. The roaring noise of a WWII aircraft engine shatters the air. Immediately, you start slamming your views left, right . . . ah there he is . . . a rapidly approaching black speck. This is how a one-on-one modem play game can begin in Jaeger's *Fighter Duel*. To put it simply, it is exhilarating! First, let's look at optimal settings.

HEAD-TO-HEAD TACTICS

Adjusting the stick and rudder response to the normal setting most accurately replicates the actual Mustang and Spitfire. Use the Thrustmaster Pro joystick and Thunderseat rudder pedals with these settings, if you can get your hands on them. With their progressive resistance, both have by far the most realistic feel and reactions compared with actual fighters, even compared to CH joysticks.

If you have a Thrustmaster stick especially, try to program your throttle to the analog setting and not digital. This means using the throttle in Fighter Duel instead of using one you programmed. This stops impossible view delays. If possible, try to put a cloud layer as low as possible (1,000 feet) and start head to head above that. This helps you to see and keep track of your opponent, which is a

CD-ROM

Check out the CD-ROM included in this book for the demo version of *Fighter Duel*.

major challenge. Even if you're playing very experienced modem opponents, you both can lose sight of each other.

YOUR AIRCRAFT OF CHOICE?

What airplane is best to use? You get many choices. If you are new take the Spitfire Mk 14. It has superb climb and turning performance that can get you out of trouble. When the two computers hook up over the telephone, using the most powerful one to be the caller is usually the best idea. This usually gives the fewest problems.

First, let us look at a head-to-head online modem duel (tournament play option). Because it specializes in modem play, you might just as well focus on that. You start at a head-on pass position. Try to choose only 12 or so minutes of fuel. More fuel makes your aircraft sluggish.

The first thing you must remember is *never, ever* lose sight of your opponent! This is actually realistic. One top gun graduate (Doug Schultz) states this is the first rule of aerial combat. Gain sight first, then never lose it. After sight, you can consider the other principles of aerial combat!

It is easy to lose sight of the opponent in this game, however. Your opponent gets lost against the background easily unless it is clouds. Once you have lost sight of him, you are blind and cannot maneuver against him. It is extremely hard to spot him again. Sure enough, your enemy will be maneuvering against you and will end up on your tail . . . unless you both lose sight of each other simultaneously! Very often the one who wins the duel is the one who spots the other again first or the one who continually keeps sight of the opponent!

So how do you keep your opponent in sight? *Fighter Duel* has no nice, cushy padlock view that keeps track of the opponent, for you when they're in normal sight limits (Jaeger might want to think of adding this option, since viewing is harder in flight simulators than in real life, of course). Think ahead and know in the back of your mind which buttons or keys (if you do not have a joystick) you are going to use as your opponent flashes past you. Plan ahead to use the 1 (over left shoulder view) or 3 (over the right shoulder) or 2 (back and up) keys to keep your opponent in sight (see Figure 15.1). If you do not do this, it is guaranteed you will lose. A second idea is to make it

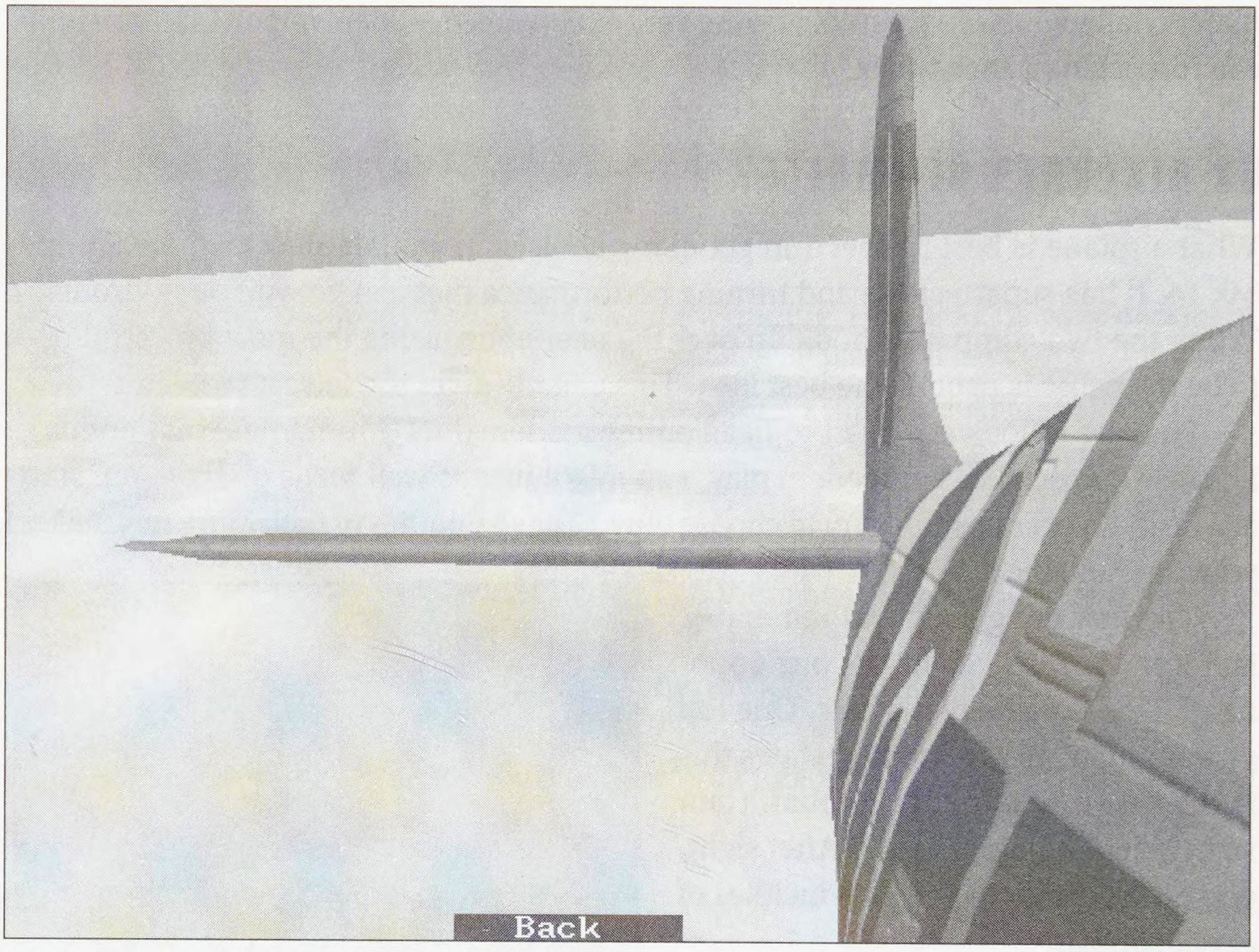


FIGURE 15.1: Plan which views to use before the pass.

a major priority to train yourself in keeping sight. Practice in the stand-alone situations to just keep sight until you are proficient at it.

THE HEAD-ON PASS

Now for the head-on pass: In real life, you are supposed to perform an early turn. This means turning a little before you pass your opponent, which gives you angles on him if he does not do the same. Unfortunately, this game does not let you do this on the first pass because you start too close to each other. However, later in the duel you might be able to do it.

Another problem with early turns is the extreme lethality of the guns. While you are turning, if he gets a burst on you, it's all over. You blow up quickly, so you have to be extra careful in performing turns. Roll first, and then pull into the turn, whether you go horizontal or vertical. This is the aerodynamically most efficient and fastest

way to turn. Do not roll and pull at the same time. If your opponent does this correctly and you do not, he will be gaining angles on you.

Now, you need to decide ahead of time whether to do a descending or climbing turn. Whatever you do, you need to turn to the right. This is always headed in his direction (which reduces angles) in tournament mode, as you can see in Figure 15.2. In this start situation a descending *slice* is not a good idea. It is best to be at corner speed (the speed at which your fighter turns the best, usually 220–250 knots) to do the slice. At the start you are already way above it! You need to get to corner speed as fast as possible, and remember that if you start a turning battle, it is a fight to the finish. At least one of you will not come out flying. As a result, you must bring your nose around as fast as possible on your opponent.

The guns are absolutely lethal. The first person to fire is usually the winner. This means reducing throttle and lowering maximum flaps almost immediately. You start out (by default) at a speed way over corner speed. Deceleration is not a strong point.

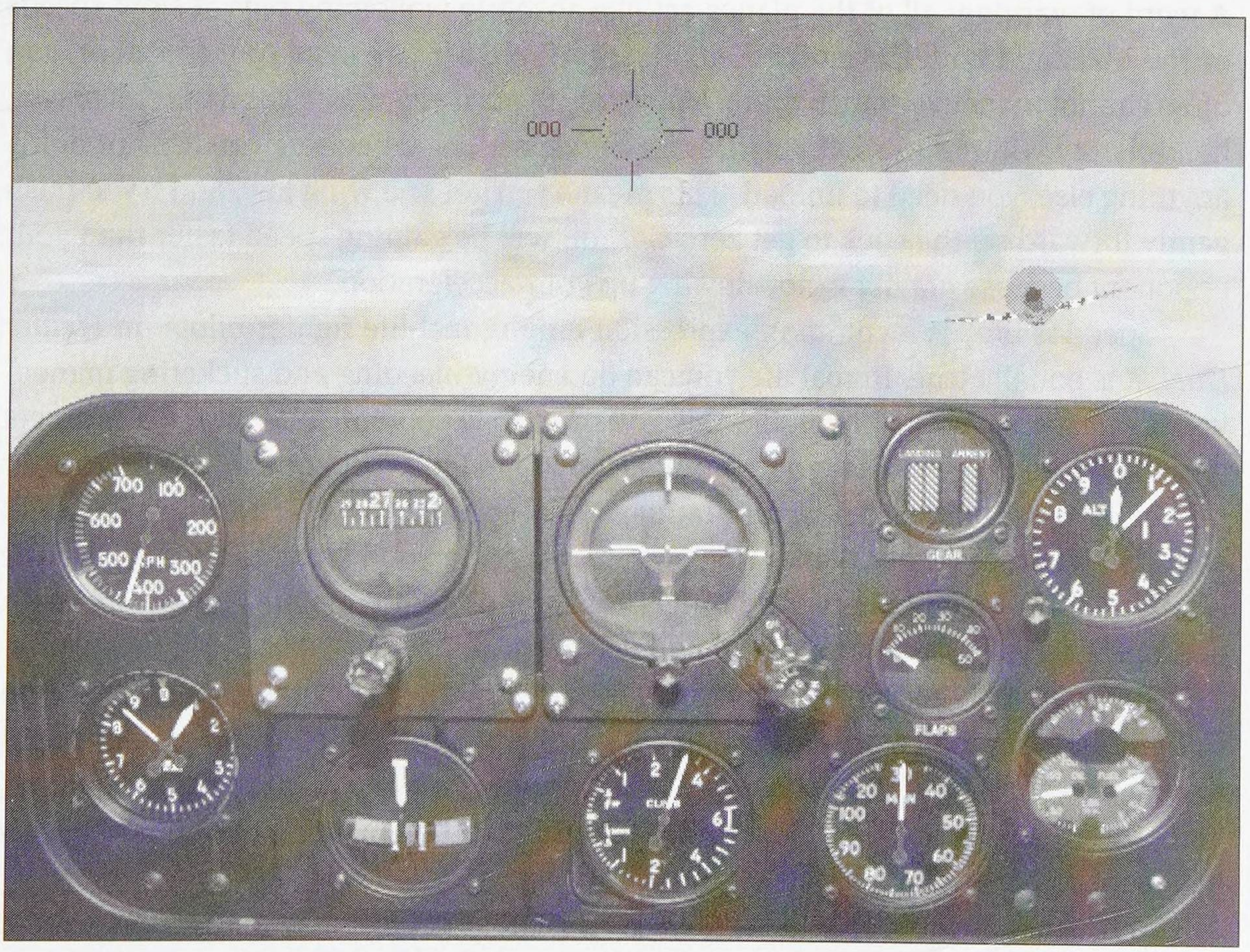
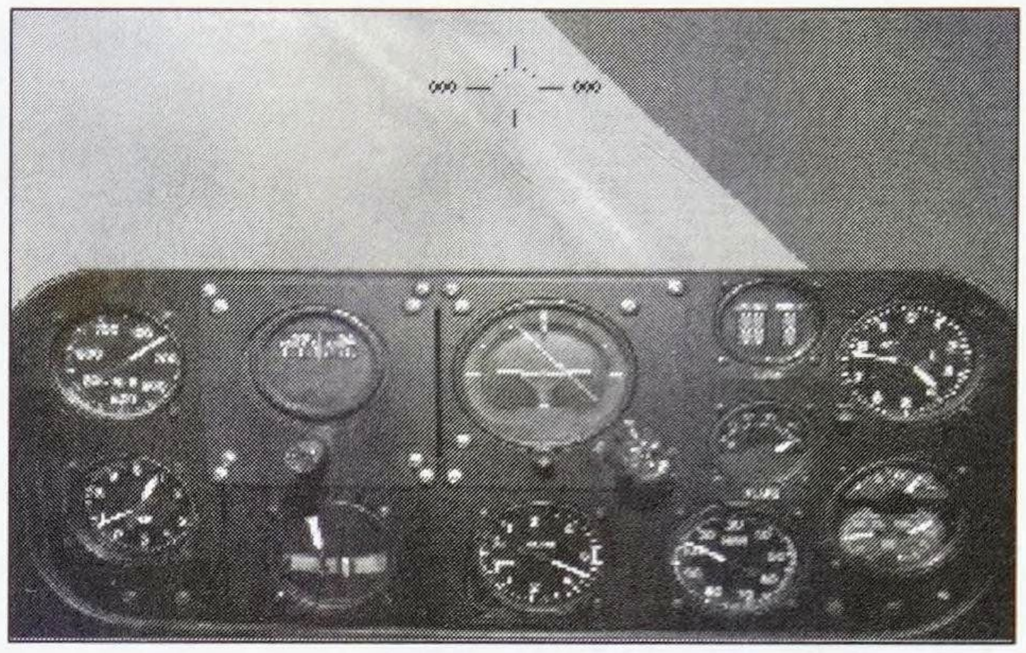


FIGURE 15.2: In tournament mode your opponent always starts to your right.

It is very hard to slow down. If you are going too fast and the opponent has slowed down to corner speed, he is going to bring his nose to bear on you faster than you can on him, and he will shoot first, usually ending the duel right there with a spectacular explosion.



So what can you do? A high yo-yo or Immelman often works out well. This means first rolling the airplane to an oblique angle (45 degrees) and then pulling on the stick (high yo-yo) or just pulling right then and there (Immelman) as you reduce throttle and add full flaps.

WATCH FOR SLOW SPEEDS!

A word of warning: all of the planes act like absolute wallowing pigs at slow speeds of 130 MPH and under, even the Zero and Spitfire. So if you miss your first shot, you often cannot maneuver much more. However, if you are against a good human player, he probably will not miss. If you are at a low speed, or whenever you are not doing anything else, you need to unload. This means you get one wing low, and try to push gently forward on the stick to get zero Gs. You will be gaining speed faster than your opponent because gravity is not slowing up your acceleration.

"Speed is life" is a common expression among real-life fighter pilots. In *Fighter Duel*, it is equally true. In real life you can do energy-bleeding and suckering maneuvers against your opponent. To do this you need to keep your speed up in a turn, get to the minimum speed needed for doing a loop, and let the opponent turn on to your tail (he or she should be below minimum vertical speed by now). Then you go up and come down on the other plane. However, this is not a good tactic to try because the aircraft do not bleed energy very quickly. The opponent ends up on your tail with enough speed to stay with you when you go vertical.

However, in a Spitfire against many types of airplanes, you can do a variation on this maneuver. When starting, immediately begin a climbing turn toward your opponent to 150 MPH, and then stay there in a climbing turn. Against many adversaries, you can stay above them and just circle around behind them doing this tactic. Try this if someone is continually beating you.

Well, those are some ideas for the tournament start option by modem play. Now, go show them who is boss.

16

Warbirds

It's here! *Warbirds* version 1.01 (the online World War II flight simulation by ICI) is officially online. Now that it has arrived, let's look at some strategies for staying alive and racking up some points! We will assume you already know how to take off (use rudder to keep it straight on the takeoff run!) and basically fly the planes.

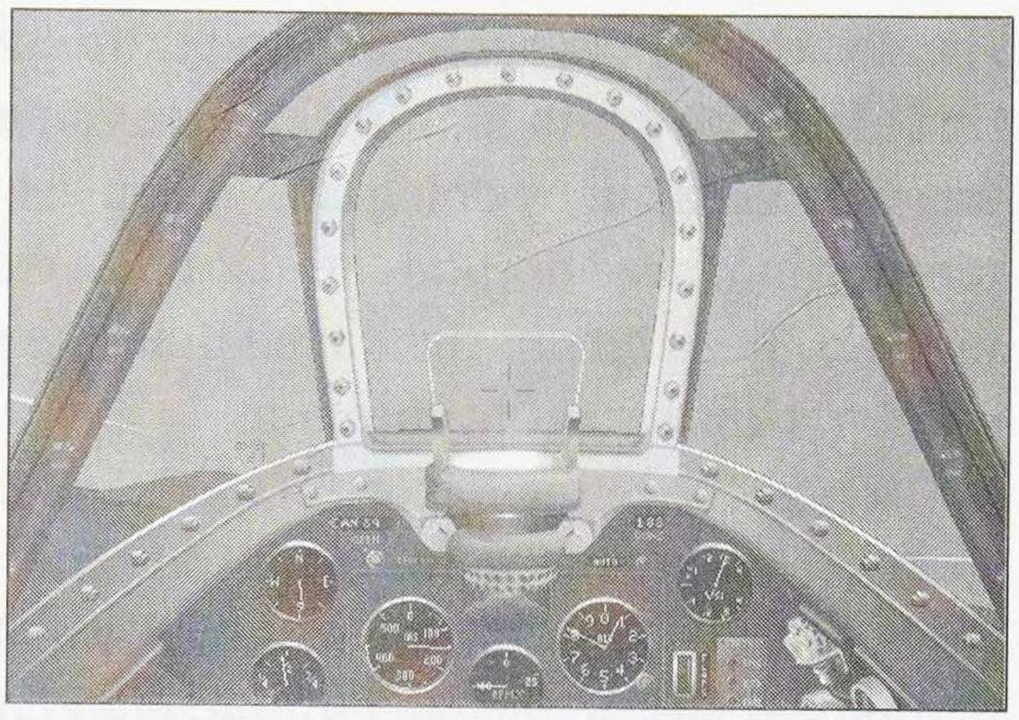
BASIC STRATEGY

First, let's look at extremely basic strategies. Before you take off, think first. You can have two general plans of action. You can jump right into the melee (and probably be shot down) or do it the way historical aces do it (get kills and live). Both are valid strategies in *Warbirds* (after all, it's only a game!).

If you want to jump in, have fun, and challenge yourself (and probably be shot down quickly), then taking off from the Hawaiian Islands from Red airfield F1 is a good, usually active place. On F1, when you first appear, look around you for enemies with all your views (nothing is more frustrating than being blown up before you even roll)! If an enemy is appearing too close, usually meaning 30 or less in range (3,000 yards) or is not being occupied by your teammates, just leave and go to another airfield. If your side outnumbers the enemies around your airfield, you can usually take off and gain height without being attacked.

The second idea is the historical one used most by aces: Get kills and live. Take off from an airfield far from the action. In *Warbirds* most airfields fit this description except F1 and F4. When you get to an airfield, look around. If you see enemies, just

go to another field. The idea here is to live and gain the historical advantages of altitude and airspeed (energy) over your opponent. Try to climb to 19,000 feet and then gain maximum speed. For this strategy fly a very fast airplane. The Mustang seems to be the fastest in *Warbirds* 1.10. If you get into trouble, you can usually escape and live.



THE MUSTANG

Let's look at fighting with the Mustang because it is the best choice in this instance, and many of its tactics will apply to other airplanes as well. Unfortunately, it is a horrible gun platform in *Warbirds* 1.10 (despite that in real life aerobatics it is as stable and as good a gun platform as anyone could possibly ask for). In *Warbirds* it bounces like a beach ball. It has a tendency to snap back to the horizon as if attached by a rubber band. It also wants to roll quickly to level if you are in a banked attitude. All of this is not found in the real TF51D Mustang. The *Warbirds* version makes hitting anything difficult (ICI is working to change things here). However, its speed will keep you alive. To help with the bounce, use the trim on angle key (Ctrl+X) all the time. If you spot someone above you, you still have a very good chance anyway by using the right tactics.

If the opponent is above you, make sure your speed is 250 MPH or more in level flight. Wait until he is almost above you. Now pull back as hard as you can, straight up without blacking out. As you get slower at the top, progressively lower all your flaps. In the Mustang you usually get a good shot at him as gravity pulls your nose down on him at the top of the loop. Now decide what to do. You can raise your flaps and try another loop (make sure your speed is at least 200 MPH), or you can also try out-turning him by using two notches of flaps full power and keeping your nose down. If he gets an advantage on you, just lower your nose, raise flaps, and escape to try it again later!

When meeting at the same altitude, at maximum-level speed, pull up when the enemy distance marker shows 20–10 (2,000 yards to 1,000 yards). When your opponent gets into your rear view, wait until you get to about 200 MPH. Then lower all your flaps, and roll the wings with your stick to keep him directly behind you. Now pull down to him.

Raise some of your flaps to get extra speed. Now either turn with him or pull back up before you get to him (make sure you are at least at 200 MPH). You can often get on someone's tail by doing this. If you get into trouble, you know what to do! When meeting him head on, you can also do an early high yo-yo, which means a sharp climbing turn. Keep him in sight at all times. Then use two notches of flaps to come down on him. Now try to out-turn him.

When above the opponent, dive down on him and try to turn with him by using two notches of flaps in the turn. You can try to stay a little above him as you turn. On the way down, you need to reduce power and lower flaps to keep your airspeed from getting too fast. If you get too fast, your controls stiffen up to the point you might as well not even be flying.

COMBAT TACTICS

While in the combat area, it is easy to have someone shoot you down without your ever having figured out why or where from! To avoid being taken by surprise, try weaving at all times. This also lets you check blind areas as well. Also, use a standard pattern of looking at all your views as much as possible. Many World War II pilots followed these two principles and were successful because of it.

The vision out of many WWII fighters is not superb because of canopy framing, the engine, and the rear bulkhead. *Warbirds* replicates much of this. So look or be cooked! In real combat, it is usually the one who sees the enemy first who wins because you can then maneuver to the opponent's tail before he can to yours without being seen. In *Warbirds* without the sun's or cloud's blinding effects yet in, it is not quite as valid but still worth thinking about.

What are you going to do when you hear the dreaded thumps of enemy shells hitting your airplane? You have only seconds or less to escape before being shot down in this situation. It calls for something drastic. "Putting everything in the northwest corner" often works, as a real WWII pilot tells in his memoirs! This means quickly putting in full left rudder as well as quickly putting the stick in the top left corner. In real life you would do an outside snap roll. In *Warbirds* you perform an outside barrel roll that usually takes you out of the enemy's bullet stream anyway (especially because *Warbirds* has no fake hit bubble around the airplane that scores near misses as hits!).

Attack with height advantage. Then attack with a numbers advantage (i.e., with many fellow teammates). Attack with the sun at your back (when ICI implements it). Never lose sight of your opponent. Always keep him in one of your views. A real top gun graduate with combat experience (Doug Schultz) emphatically offers the idea of

never lose sight is the most important concept in air combat. Another idea ported over from real life is to get close before firing (200 yards). These are standard tactics of the real aces.

KNOW YOUR PLANE'S LIMITATIONS

You must also know the strengths and weaknesses of your individual plane. As real WWII pilots did (so to speak), take it up offline and play with your airplane. It sounds inane, but it really helps. It takes a while to learn how to control your airplane at the edge without losing control. They are all very different. Time your turns with a stopwatch with different flap settings and speeds. Practice using rudder to increase the roll rate. Do split-S maneuvers (roll inverted and pull the stick into your lap) and learn the minimum altitude needed for the split-S (this is a great way to make someone who is on your tail crash!).

One problem you will have to deal with in *Warbirds* is head-on passes. This means two airplanes converging head on. In real life, the closer you can get your nose to the opponent as you pass each other the better your advantage in subsequent maneuvering. In *Warbirds* it usually means dying by a collision! Head-on shots do not seem to be a major source of kills in *Warbirds*—especially if you are maneuvering in an artificially bouncy airplane—but collisions are! As a result, try doing an early turn in the vertical or horizontal before you pass your opponent. This is a standard tactic of experienced fliers anyway.

17

NASCAR Racing

OK, hot shot—before you climb into the cockpit and blow the doors off NASCAR's best, you've got to earn your way into the driver's seat. So roll up your sleeves and get ready to get some dirt under those fingernails. It's time to learn your way around the garage.

DOWN 'N' DIRTY

You may not feel at *home* in the garage. In fact, you may not know a sway bar from a bar of soap. Even if you have no interest in becoming a master mechanic, you should at least learn what makes your car go. I'll give you some fast setups, but none will be as fast as a setup tweaked especially for your own driving style.

No one knows better than the driver how a car is behaving on the track. Even if you don't care about down force and torque or about drag and camber, you'll still benefit from a basic understanding of car setup. And where can you turn for advice when your car suddenly gets dangerously loose? You can only turn to your knowledge of your equipment and your own instincts.

CHOOSE YOUR WEAPONS

Direct involvement by automakers in the United States is not as intense today as it was in the 1960s; although, GM and Ford are still very much a part of the sport. The reason is simple, the automakers reason: win on Sunday (with the world watching), sell on Monday.

*This chapter originally appeared in *NASCAR Racing Strategies & Secrets* by Lee Buchanan, also published by Sybex, Inc.

Brand loyalty is greater among NASCAR fans than in any other form of auto racing, and it's usually a family tradition, an allegiance as strong as blood. My dad was a Chevy man, so I naturally stepped in line. I've never owned a Chevrolet, and I drive (gasp!) a Honda now—but when it comes down to a battle between Chevy and Ford, in my mind it's no contest.

You're probably not bound by that sort of blind, redneck loyalty to a make of car, so you should test-drive the three available models before you choose. They're separated only by slight differences in handling characteristics. And if you want to blame your pathetic performances on your car, you can always change horses in midseason.

NOTE

Quick, name the model that ruled NASCAR racing in the early 1950s. Chevy? Ford? How about Chrysler? Nope. Try the mighty Hudson Hornet. Powered by a 6-cylinder, twin-carb engine, the Hudsons took the season championship from 1951 through 1954, winning 79 races in the process. The Hornet was fast enough, but it was the car's unique chassis design that made it virtually unbeatable. A system of wrap-around frame rails allowed the body to sit closer to the ground, giving the Hudson a lower center of gravity and superior handling characteristics in the turns.

Chevrolet Lumina

The Lumina, shown in Figure 17.1, hasn't been one of Chevrolet's better race cars, and by the 1995 season it has been replaced by the sleeker Monte Carlo after being consistently outrun by the Ford Thunderbird. In the game, the Lumina has slightly more rear down force, making it a tick faster than the Thunderbird down the straightaways of longer race tracks.

If you'd rather climb aboard the Monte Carlo, you can use the Paint Kit to touch up the detail of the Lumina to make it closely resemble the newer Chevy. If you're not much of a graphics artist, and you have access to an online service such as CompuServe, you'll find several car-sets, uploaded by other racers, that include the new cars.

Ford Thunderbird

The clean lines of the T-Bird have helped make this car one of the most successful race cars in recent memory, as shown in Figure 17.2. The Thunderbird has more than held its own against Chevy since Bill Elliott tore the circuit to shreds in the late '80s.

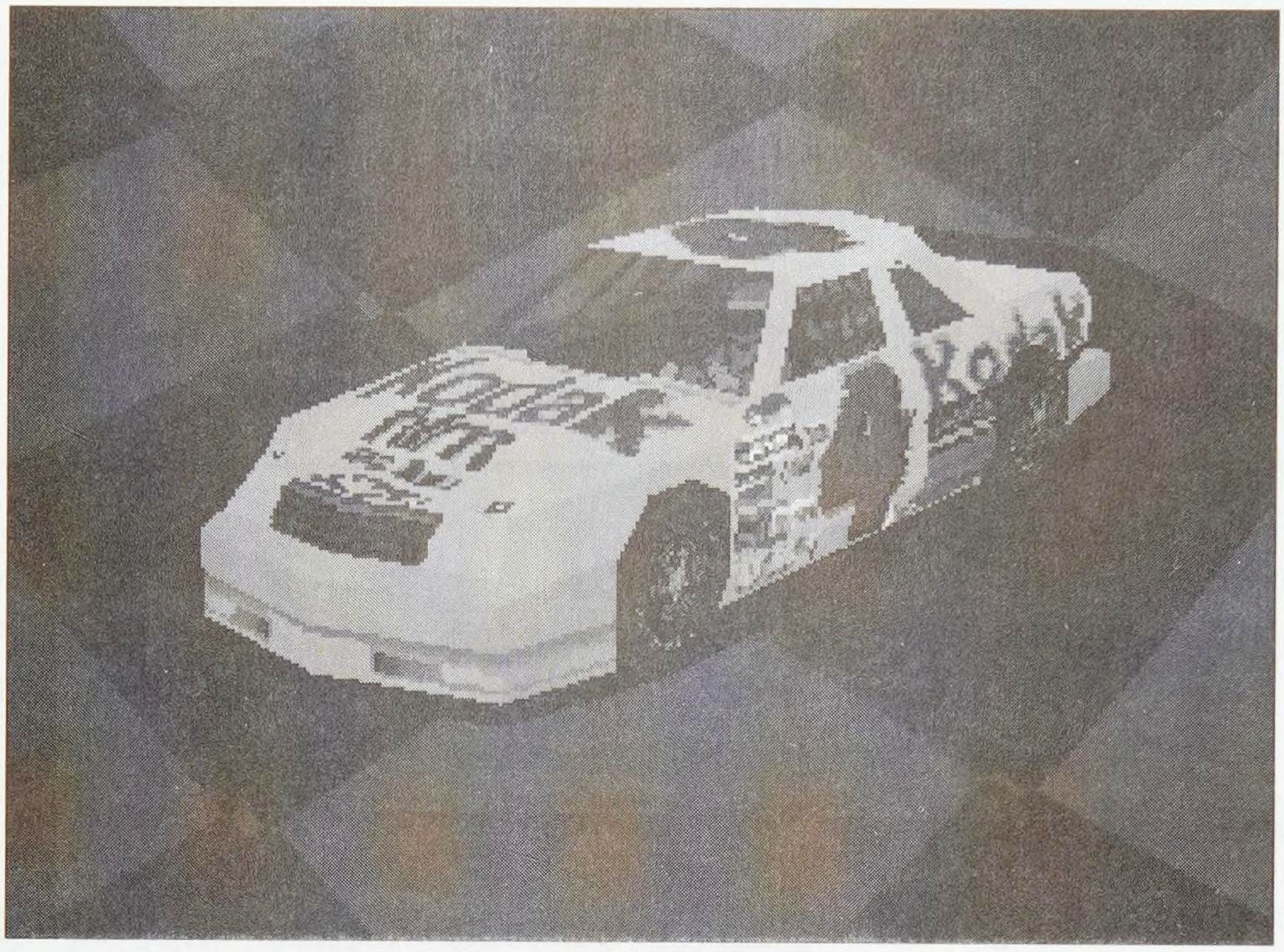


FIGURE 17.1: The Lumina isn't the best race car ever fielded by Chevrolet, but you can still win with it.

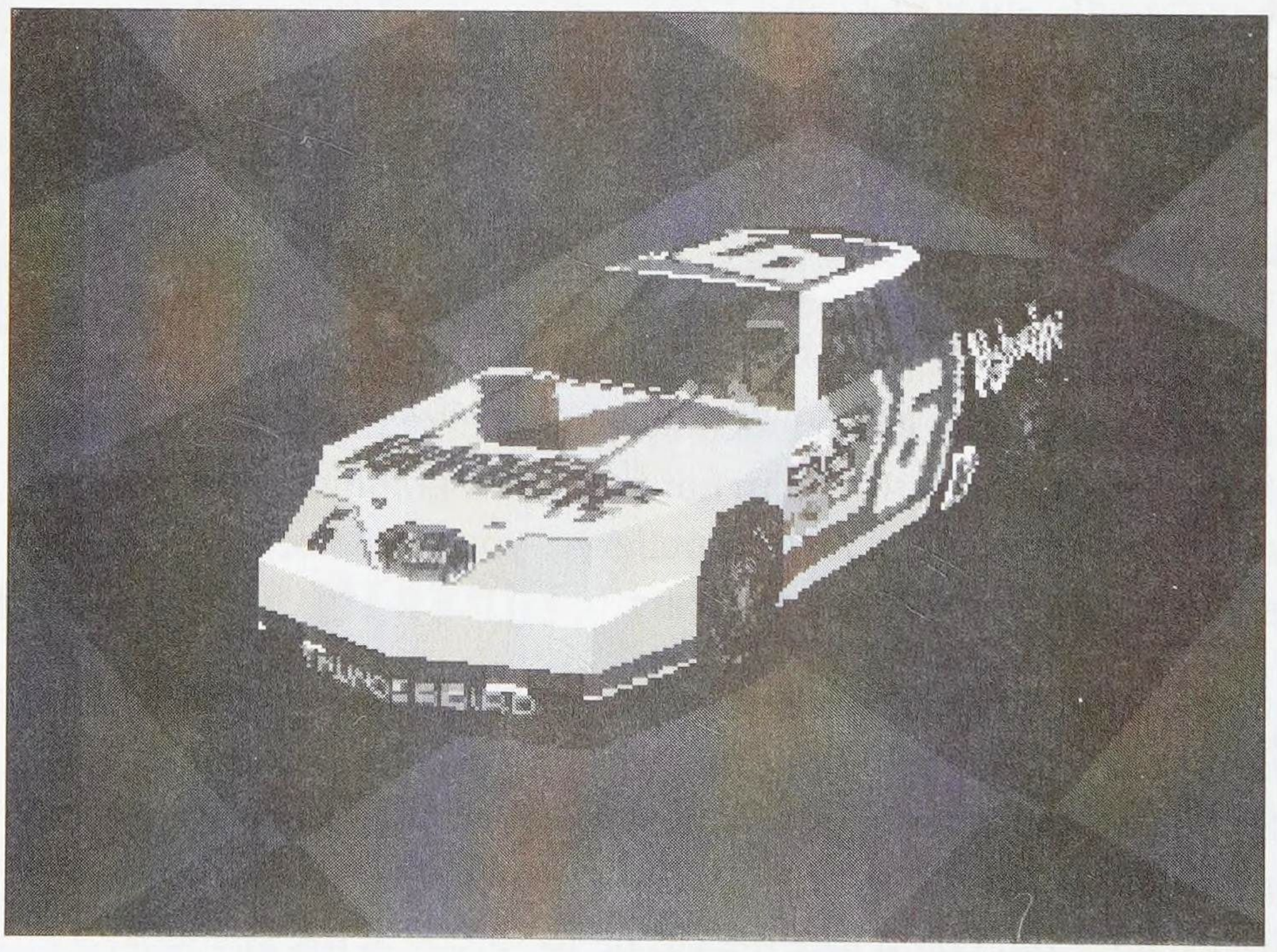


FIGURE 17.2: The Ford T-Bird might be your best choice, especially when you're learning the ropes.

In the game, slightly better front-end down force makes the Ford a stout short-track car, while it may trail the Lumina down the faster straightaways.

Pontiac Grand Prix

If you can't choose between the Chevy and the Ford, you should take the Pontiac for a test-drive. The Grand Prix is a stable race car, somewhere between the Lumina and the Thunderbird (Figure 17.3). NASCAR rule changes made the Grand Prix more competitive in the 1995 season, but of course that won't help you here. Give it a spin; Pontiac could use some more teams on the circuit.

ANY CAR WILL DO Car selection is largely a matter of personal preference, so don't agonize too much over the decision. There's no magic make of car that will transform you from a back-marker to a front-runner. Until you get a feel for how the car is behaving on the track, you won't be able to distinguish among the three models.

If you're just starting out and can't decide which car you want to drive to wealth and glory, choose the Ford Thunderbird. The slightly greater down force makes the

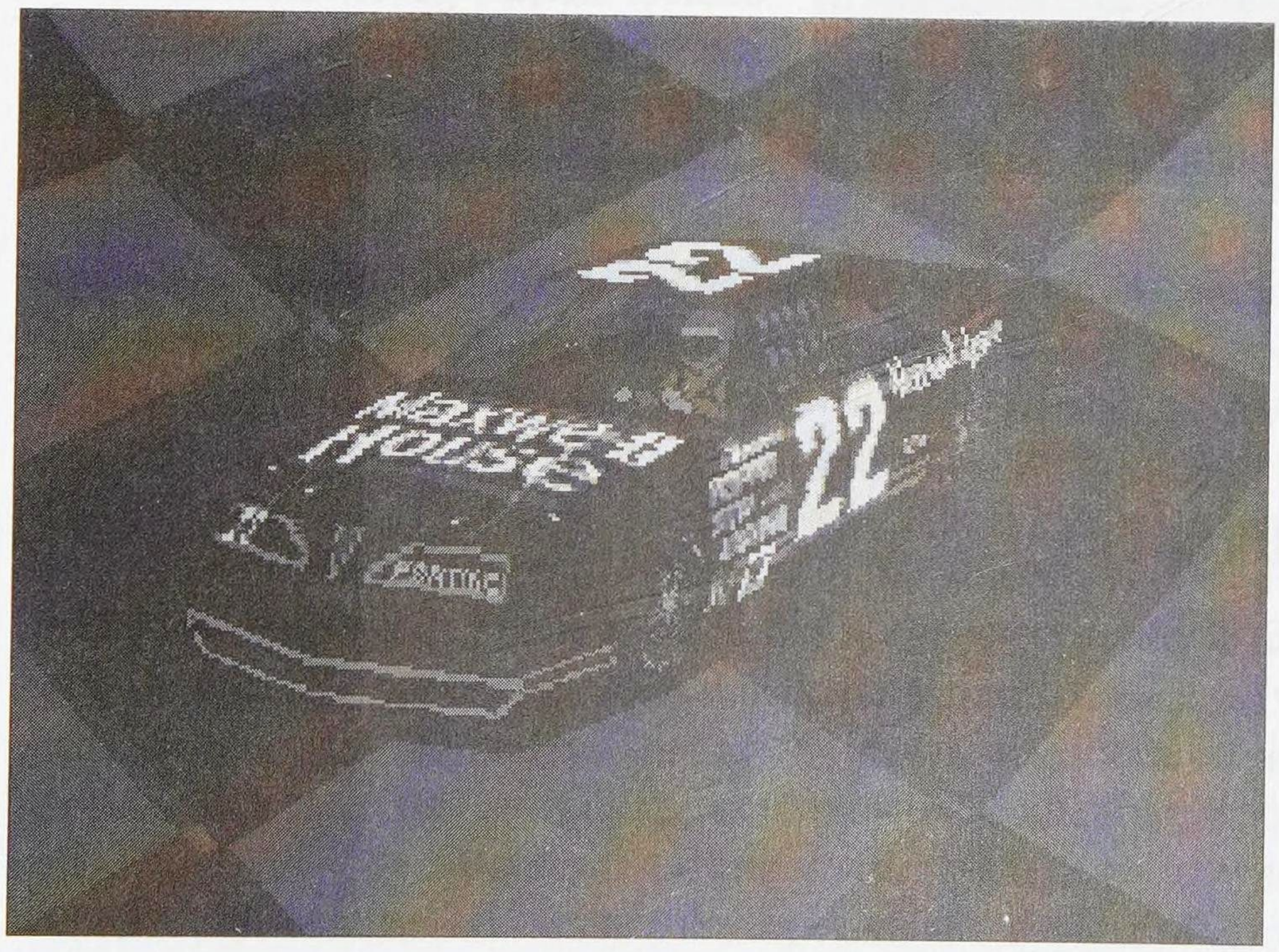


FIGURE 17.3: The Pontiac is a solid compromise between speed and handling.

T-Bird a little more stable on the shorter tracks, yet won't slow the car appreciably on the superspeedways. If your momma drives a Chevrolet, though, you'd better think again before she gets on your tail about it.

Where the Rubber Meets the Road

Good slogan, but the wrong company. When Papyrus developed the game, there was a tire war raging in NASCAR. Goodyear has long dominated the sport, but in 1994, race-tire specialist Hoosier developed tires for NASCAR's premier division and set off a controversial competition that saw the companies pushing the limits of tire performance. Tires got faster, but drivers worried that safety was being sacrificed for speed. Hoosier pulled out of the sport after the 1994 season, and now Goodyear once again is the unchallenged tire source.

NOTE

Because you're also the racing commissioner, you can force everyone to run Goodyears—or Hoosiers, for that matter. If you're a stickler for realism, make 'em run Goodyears. That will help put all the cars on the same pit-stop sequence, though some will pit earlier or later anyway.

Because the game is based on the 1994 season, however, you still have a choice. In the game, Hoosiers have slightly better grip, so they run a shade faster than the Goodyears. Better grip also means greater wear, so you'll have to change 'em more often than the steadier Goodyears.

Most of your competitors run Goodyears. Pay attention during green-flag pit stops and you can pick out the ones running Hoosiers. They'll be forced to pit several laps before the Goodyear-shod cars.

TURNING THE WRENCHES

Most of the NASCAR greats were also ace mechanics and chassis experts. They *had* to be. In the early days, your pit crew might consist of your brother-in-law and a couple of the guys who hung out down at the gas station. You built the car, set up the chassis, lifted some spare parts, turned the wrenches, and then you raced it. And when you wrecked, you were up all night hammering out the dents.

Today, there's a different breed of driver—the hired guns who just show up at the track to race. They get all of the glory and none of the grunge. So which do you want to be?

The beauty of *NASCAR Racing* is that you aren't forced into one role. You can put on the hat of the old-style driver, turning the wrenches in the garage, and then turning the wheel on the track. Or you can be one of the new-generation pretty boys, eager to get to the victory lane so that you can do a TV interview surrounded by babes

You can run fast—and win plenty of races—just by loading the hot setups. But one thing's certain: You'll be a faster and better driver on the track *if* you've done your time and got some grease under your nails in the garage.

TIP

Save your setups as you go, deleting old files to avoid confusion. Start with the stock Ace set-up (or another one you like better), run enough laps to get the tires nice and hot, and then note your fastest speed. Let's say you're at Bristol and you run 121.234 MPH. Save that setup as 1212, then begin your work with a single adjustment, maybe a stiffer right-front shock. Go back out, run the same number of laps, and check your fastest speed again. If it's faster, say 122.106—and feels fairly comfortable to drive—save the new setup as 1221. Delete the old file or keep it as a backup. Repeat the process with your next adjustment, saving each one that's faster than the one before.

The Quest for Speed

The process of setting up a race car has two fundamental stages: making adjustments in the garage and testing on the race track. Too bad it's not as simple as it sounds! It's a long, laborious, and maybe even boring process. Run the car 20 laps, see how it's handling, and then adjust the rear weight bias by a percentage point or two. Run 20 more laps, check the tire temperatures, and put in another pound of air. Then it's 20 more laps, check temps, and make another tiny adjustment. That's why when these guys aren't racing, they're practicing. You'll find precious little free time in the big leagues of racing.

It's just a game, I know, but if you're serious about car setup, you have to approach it the same way. There's nothing wrong with jumping into the game, loading somebody else's setup, and taking the green flag. Heck, that's what most of the real drivers do these days. This section, however, is for players who want to get into the guts of the simulation—for the motorheads who want to try to squeeze another two-tenths of a second out of their lap times.

The single most important thing to keep in mind: Never make more than one adjustment at a time. If you stiffen the right-front shock and lower the air pressure in that same tire, and then discover the tire's overheating after several laps, you won't know which

adjustment is causing the problem, or whether it's the combination of changes. This method of checking variables—limiting yourself to making one adjustment at a time—may be time-consuming, but it's less confusing and will pay off in results.

Practice Perfect

In between adjustments, of course, you'll take the car out on the track to see how it behaves. It's critical you approach each of these practice sessions the same way. Run the identical number of laps, and "go for it" to the same degree for each session. The tire temperature readings will be meaningless unless you run a sufficient number of laps to get the tires up to racing temperature. Run at least 5 laps on the short tracks, and 10 on the longer tracks (1.5 miles or more). It sounds screwy, I know, running more laps on longer tracks—but the tires heat up faster in the turns, and you're in the turns most of the time on the short tracks.

Get in the habit of checking the tire temps at the same point on the track. Immediately on exiting a turn is a good place, because the tires should be hottest there. As always, use the Pause button when you take your eyes off the track for more than a split second. Try to run consistent laps as you work on your setup, braking and getting back on the gas at the same places on the track.

TIRES: YOUR LINK TO THE TRACK

"How are the tires holdin' up?" That's probably the most frequently heard question in the garage area of a NASCAR race. Aside from your driving ability, tires are the single most important factor determining your car's speed and handling characteristics. While you can't change the tires—except for swapping brands—every adjustment you make to the chassis has an impact *on* the tires.

Hot and Cold

Tire temperatures are the one constant factor in all your garage work. With the exception of aerodynamics and wheel lock, every aspect of car setup influences—and is influenced by—tire temps. You'll constantly be chasing these numbers, so get used to it.

Temperature is measured at three points on the racing surface of the tire: inside, middle, and outside. That means the tire is gripping evenly across its surface, giving it a more stable "footprint" on the racing surface. Your goal is to get tire temps within an acceptable range and even across the tire. Ideally, you want even tire temps in a

range of 200–225 degrees. Below that range, the tire isn't gripping as well as it could. Run hotter than 225 and you shorten the life of that tire. You'll never reach the peak temperatures on all four tires, even though that's your goal.

Performing Under Pressure

In general terms, lower air pressure makes a tire stick better and run hotter, while higher pressure results in cooler temps and less grip. Below an acceptable pressure—it varies based on other adjustments—the outside temperatures will run hotter than the middle. Above that range, the middle of the tire will get hotter than the outside temps.

On most tracks, the right-side tires take the burden of the car's weight as it travels through left-handed turns. You'll often be battling hot tire temps on that side of the car, so bumping up the pressure slightly may be an easy fix. The left-side tires, by contrast, often don't get hot enough, especially the left front. Try lowering the pressure there to build some more heat. On many tracks, though, you'll never be able to get the left-front tire temp into the desired range.

Stagger

Running slightly larger tires on the right side enhances the ability of the car to turn in the corners. The right-side tires actually have to travel a greater distance on the outside of a turn than the left-side tires, which are taking the shorter route on the inside. With no "stagger," the right-side tires have to work harder—actually turning faster—than those on the inside. To compensate for this, you

TIP

Start with the pressures in the Ace set-up, but these are usually in the low end of the acceptable range. You can usually increase the pressure by three or four pounds from the Ace setting and maintain even temperatures. This should cool the tire slightly and extend its life, without losing any grip.

TIP

Tire temperatures are affected by a number of factors, including your driving line. As you get faster through the corners, the tires will run hotter and are more likely to build heat on the outside. A set-up that worked fine at Martinsville turning laps at 88 MPH may be abusing the tires if you've turned it up to 93 MPH. That's why you shouldn't worry about set-up until you've learned your way around a particular track.

can put tires on the right side with a slightly greater diameter, as shown in Figure 17.5. This enables them to travel the greater distance in fewer revolutions.

If your car is pushing in the turns (understeer) on an oval track, try increasing the stagger setting slightly. This should help you turn left more easily. Don't go too far with the stagger, though. Too much of a size difference between the left- and right-side tires will cause the car to pull too hard to the left, scrubbing off speed and increasing wear on the tires.

Stagger is effective only on the ovals, where you're turning left all day. You'll want a neutral setting here on the road courses, maybe even a slightly negative setting to help with tough right-hand corners. Stagger works best on the short tracks, where you spend most of your time in the corners. You'll want less stagger on superspeedways.

As with most other adjustments, changing stagger has a ripple effect on other settings. Camber, in particular, will require another look after you change the stagger. Run a few hot laps and check tire temps, and then make another camber adjustment.

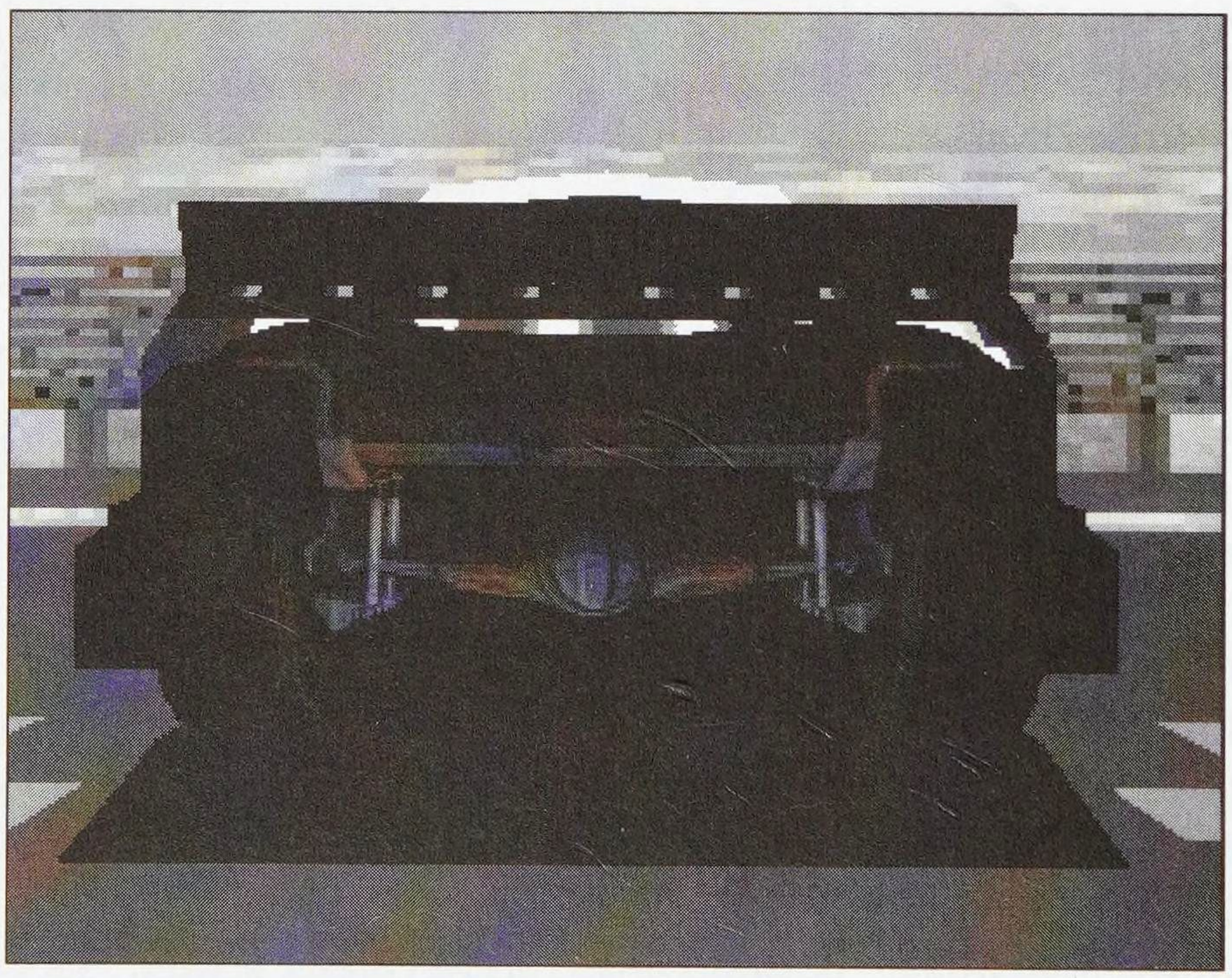


FIGURE 17.5: Racing on the ovals means all left-hand turns. Larger tires on the right side will help the car turn more easily.

Camber

The term "camber" denotes an angle adjustment to the front wheels that determines how those tires make contact with the track while cornering. Take a look at the camber graphic of the right-front, shown in Figure 17.6, or on the screen when you're in the garage. If that tire is making even contact with the ground when the cars at a standstill, what will happen when the car slams into the banking at high speed, and all that weight shifts to the right side? That's right, Billy. The outside edge of the tire will take most of the weight, while the inner half may be barely gripping the track at all. Not good.

To compensate, you can adjust the camber, or the angle of the tire to the track. A neutral setting means the tire is perpendicular to the ground. That's fine when the car is parked, but it won't work for high-speed cornering. By increasing that angle—actually tilting the wheel slightly inward—you prepare the wheel for the conditions it will experience under high-speed cornering.

SETTING CAMBER Camber is measured in degrees: zero degrees is perpendicular to the ground; a positive reading tilts the wheel outward; a negative reading tilts

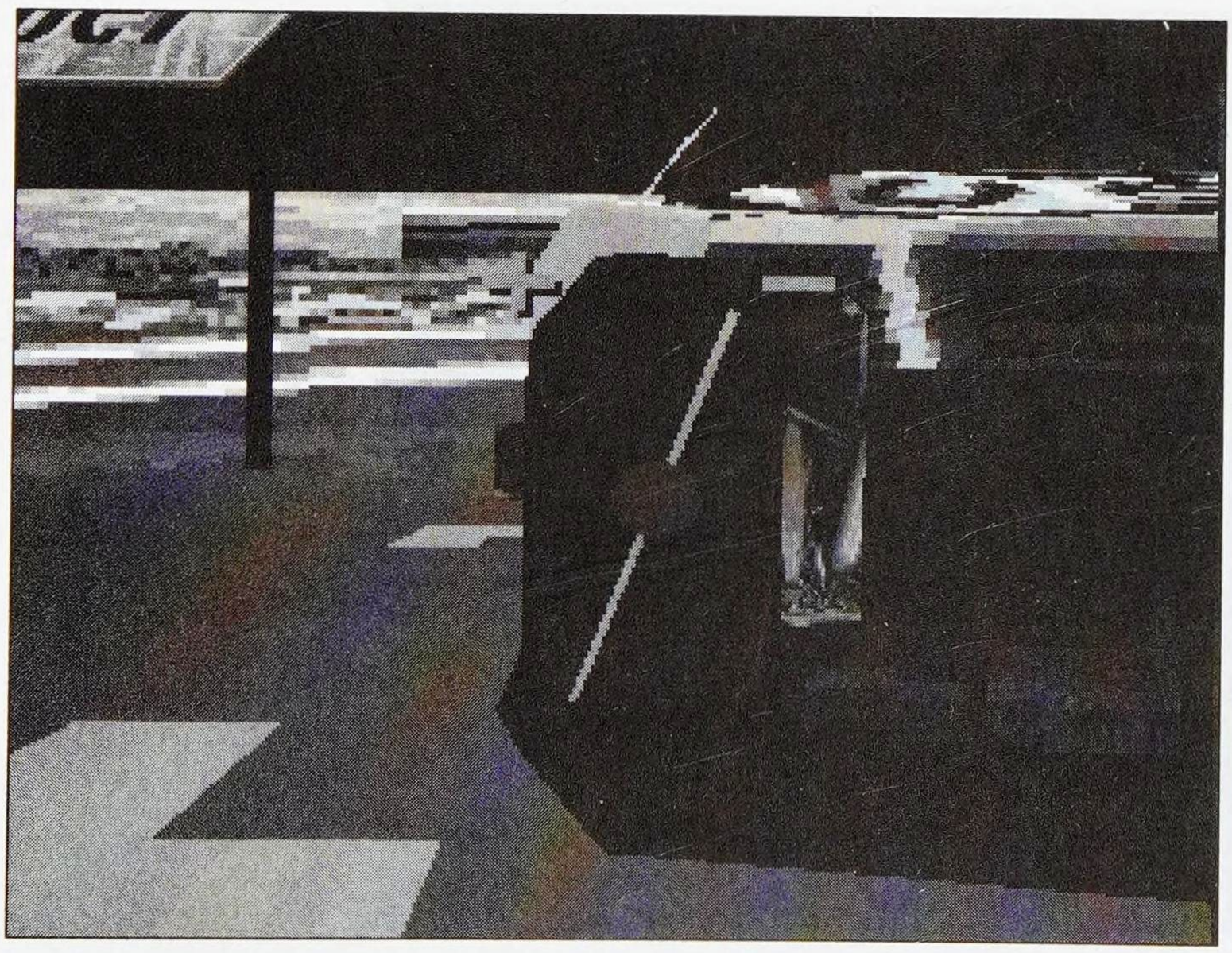


FIGURE 17.6: The camber setting affects how the tires make contact with the track.

the wheel inward. Don't worry about a positive reading—you'll never use one. Rather, your job is to find the degree of negative camber required to produce even tire temps at a given track.

Run several laps in practice to get the tires up to racing temperature, and then pause the game after you exit a turn and check the temps. If the outside reading is higher than the middle and inner temps, reduce the amount of negative camber. If the inner part of the tire is hotter, increase the setting. As always, make slight adjustments until you get a feel for how the changes affect the readings.

SUSPENSION

Shock Treatment

In racing, shock absorbers, as shown in Figure 17.7, do a bit more than helping to smooth out the bumps in the road. You're looking for high-speed handling not a smooth ride. By stiffening and softening a wheel's shocks, you can adjust how much weight is transferred to that wheel in relation to the others. This can have a drastic impact on

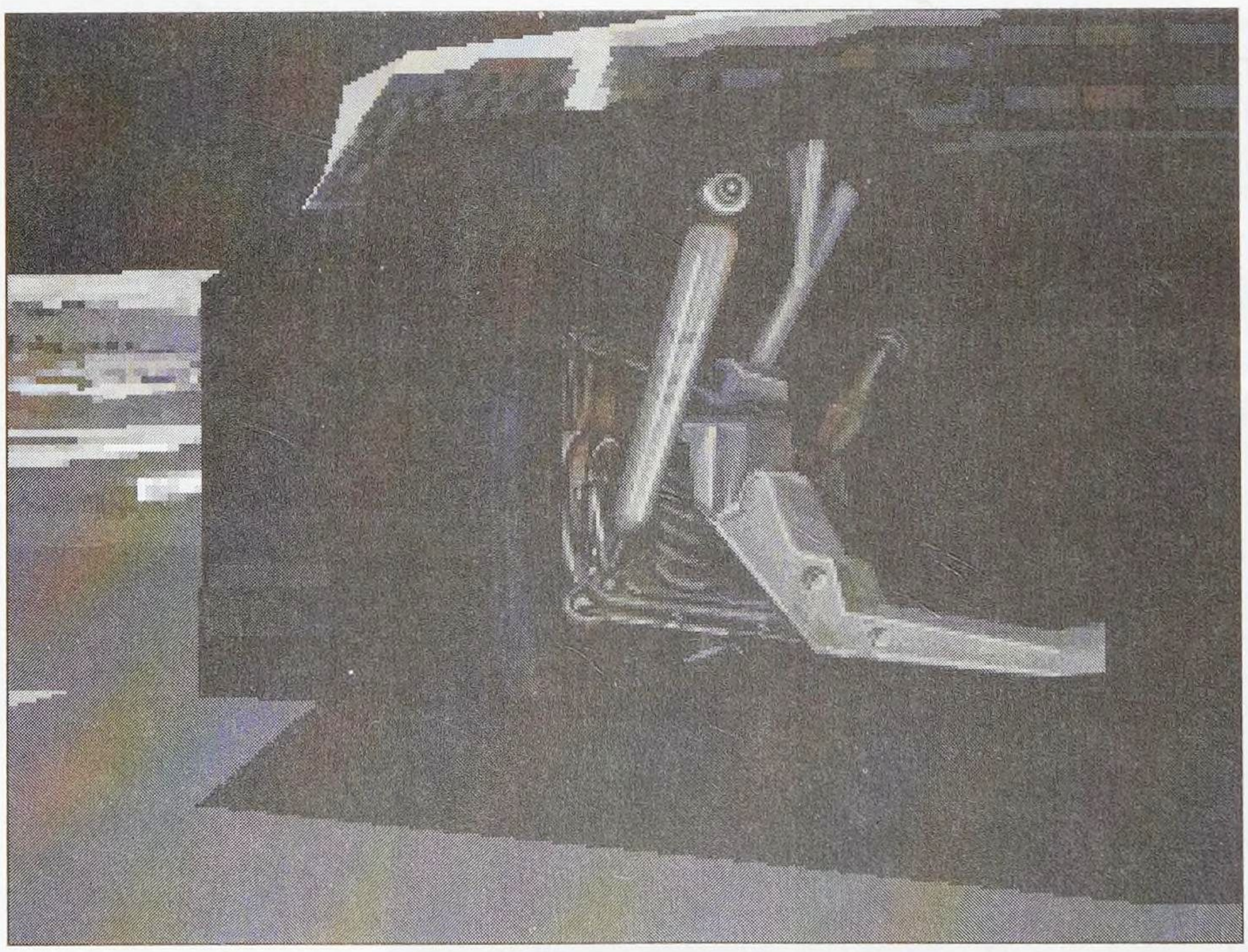


FIGURE 17.7: The stiffness of the shocks helps determine how weight is transferred.

a car's handling characteristics and tire temperatures, so treat these babies with respect. Keep shock adjustments to a minimum, unless your setup is way off and you're looking for a major chassis change.

WORK ON THE TEMPS Shocks are a good place to start when you're trying to get tire temperatures into the desired range. It depends on the track, of course, but the right-front tire is almost always the trouble spot on an oval track. If the right-front is running dangerously hot, soften the spring to put less weight on that corner of the car in the turns. The left-front, on the other hand, almost always runs well below the 220–225 degree range. If you can't get enough heat into that tire, set the shock to 100 percent stiffness. Work with the shocks all the way around the car—remember, one change at a time—trying to get the tire temps as close together as you can, and within the desired range.

TIP

When you're just earning your NASCAR driver's license, you may want to go with softer shock settings all the way around. The transference of weight from wheel to wheel will be a bit slower, giving you more time to react. Later on, when you get more skilled behind the wheel, you'll want to stiffen the suspension. The weight transfer will be more abrupt through the corners, giving you finer control, though it's much easier to lose control if you're not ready.

GETTING A HANDLE Shocks also help determine how your car behaves in the corners. If the car is pushing, soften the shocks on the front wheels to get better grip up front, or stiffen the rear shocks, or try a combination of front and rear adjustments. To help cure a loose situation, try the reverse: stiffer front shocks and/or softer shocks in the rear.

DIALING IT IN After you've come up with a stable, fast setup, you can make minor adjustments to the shocks to change how your car behaves at various points on a race track. It's important to remember, though, that we're talking about fine-tuning the chassis here. Don't try this until you already have a solid setup.

First, let's look at what happens as your car goes through a turn. As you enter a corner, the car decelerates and begins to lean to the outside. Weight shifts to the right side (on an oval), and thus to the shocks on the right-front and right-rear wheels. As

you accelerate off the corner, that weight rolls back over the center of the chassis, and the left-side shocks are absorbing a greater share of the weight.

It's common for the car to push straight ahead (it doesn't want to turn) when entering a turn. To help cure this problem, soften the right-front shock and/or stiffen the left-rear shock. This should increase the grip of the right-front tire and help you steer low when entering the corners.

The car is often loose coming off a turn, with the rear end losing traction. To ease this condition, stiffen the left-front shock and/or soften the left-rear shock. This will tighten the chassis coming off the turn without creating a "push" when entering the turn.

Wedge

Let's get this straight right away: Those pretty Indy boys may call it cross weight, but in NASCAR it's called "wedge." So enough of that cross-weight talk here. You're in NASCAR country!

Consider wedge adjustments a quick fix to what's ailing your car's handling. Wedge is a way of varying the amount of weight carried by the right-front and left-rear wheels. By decreasing, or taking out, wedge, you can help alleviate a push or understeer condition. Increasing the wedge setting tightens up the car, helping to cure a loose condition.

Think of a table with the left-rear and right-front legs a tad shorter than the others. You can tip the table slightly toward either of those shorter legs. And after the Thanksgiving turkey slides onto the floor, you fold up a piece of paper and stick it under one of the legs to stabilize the table. That's sort of how wedge works, tilting the chassis slightly toward the left-rear or the right-front.

TIP

When first setting up a car on a track during pre-season testing, use shocks, left bias, and rear bias to come up with a good chassis setup. Try to leave wedge at 50 percent, or neutral, in this initial setup. Then when you come to the track on race day, you can use wedge adjustments to "dial in" the car based on the current weather and track conditions. Wedge is also your most valuable adjustment during pit stops, so try to save it for adapting to conditions during the race.

WEIGHT MANAGEMENT

Weight transfer is the key to how your tires react under high-speed conditions, and therefore how well your car handles through the turns.

To get a feel for how these various adjustments work, you have to understand the dynamics at work as your car races around a track at high speed. The same forces are in play when you're driving your mini-van to the grocery store, but they are magnified a bit when you're roaring into turns at 190 MPH, at the very edge of control.

> **TIP**
>
> **Work on your race setup with about a half-tank of fuel in the tank. If you come up with a blazing fast setup on a full load of fuel, the car's handling is likely to go away as the race wears on and you burn fuel.**

We tend to think of weight or gravity as an unchanging natural force, but when an object is in motion, it's more accurate to think of weight as fluid energy. The 3,500-pound object that is your race car is in a constant state of flux as it barrels around the track. When you hit the gas, weight is shifted to the rear of the car. Mash the brake pedal, and that weight is thrown forward. And as the car rounds a curve, weight is transferred to the side of the car on the outside of the turn.

The vast majority of your set-up time is devoted to controlling and compensating for this weight transference. Left bias, rear bias, and cross-weight adjustments are meant to minimize these shifts in weight, thus making the car more comfortable to drive. That's enough technical stuff, huh? (Jeez, I'm sure glad racing doesn't involve chemistry . . .)

Left Bias

Since most of the NASCAR boys—and an occasional gal—do most of their turning to the left, chassis experts put as much of the weight as they can on the left side of the car, to the inside of the turn. Each car must weigh in at inspection at a minimum of 3,500 pounds, but the teams have some discretion about how they achieve that weight. The car can be as light as the teams can build it, then the extra weight can be moved around the chassis to achieve the desired effect on handling.

Of course, nobody's ever bolted a lead bar under the dashboard to get through pre-race inspection, and then removed it before the race started. That would be cheating.

The left-bias setting determines how much of that weight goes to the left side of the car. This is no high-tech solution. The weight consists of bars of lead or titanium, bolted to the frame.

The solution here is simple: Start out by setting left bias all the way to the legal limit on the ovals. On the shortest tracks, you'll probably want to keep it to the maximum setting. For the superspeedways, where you spend much less time in the corners, try shifting a bit of the weight to the right, but keep these adjustments very slight.

The road courses are a different story. On both Watkins Glen and Sears Point, there are more right turns than left turns, so you'll want more weight on the right side. Don't go overboard shifting weight to the right, though, because you have to turn left some, too.

Rear Bias

No, this doesn't mean you don't like people's butts. (Well, maybe you don't, but that's your business.) Our business here is *racing*, and rear bias refers to the amount of weight that you pre-load into the front and rear areas of the chassis. Rear bias can have a tremendous impact on how the car behaves during acceleration and braking. In general, moving weight forward will tighten the car, while shifting weight to the rear will make the car looser.

At 3,500 pounds, a 50 percent rear-bias setting is neutral, with 1,750 pounds each in the front and rear of the car. On high-speed tracks, the near-constant acceleration moves some of that weight to the rear, which tends to make the car loose. By starting out with more of the weight at the rear of the car, you can reduce the effect of that weight transference under racing conditions. At shorter tracks, you'll want less of the weight in the rear because you're not accelerating as much. Remember, though, these are very slight adjustments, and you'll probably want slightly more weight in the front at any track.

As driver Dave Marcis says in the manual, "The front percentage of the race car, at, say, Talladega would perhaps be around 52.5 to 53 percent. If you were at a race track like Martinsville, the front percentage of the car would only be about 50.5 to 51 percent." Thanks, Dave.

Wheel Lock

This setting determines how sharply the front wheels turn when you crank on the steering wheel or the joystick (see Figure 17.8). It's largely a matter of personal preference, but I find the stock settings—15 degrees—far too high. A slight jerk on the wheel can turn you straight into the wall. Ay, caramba!

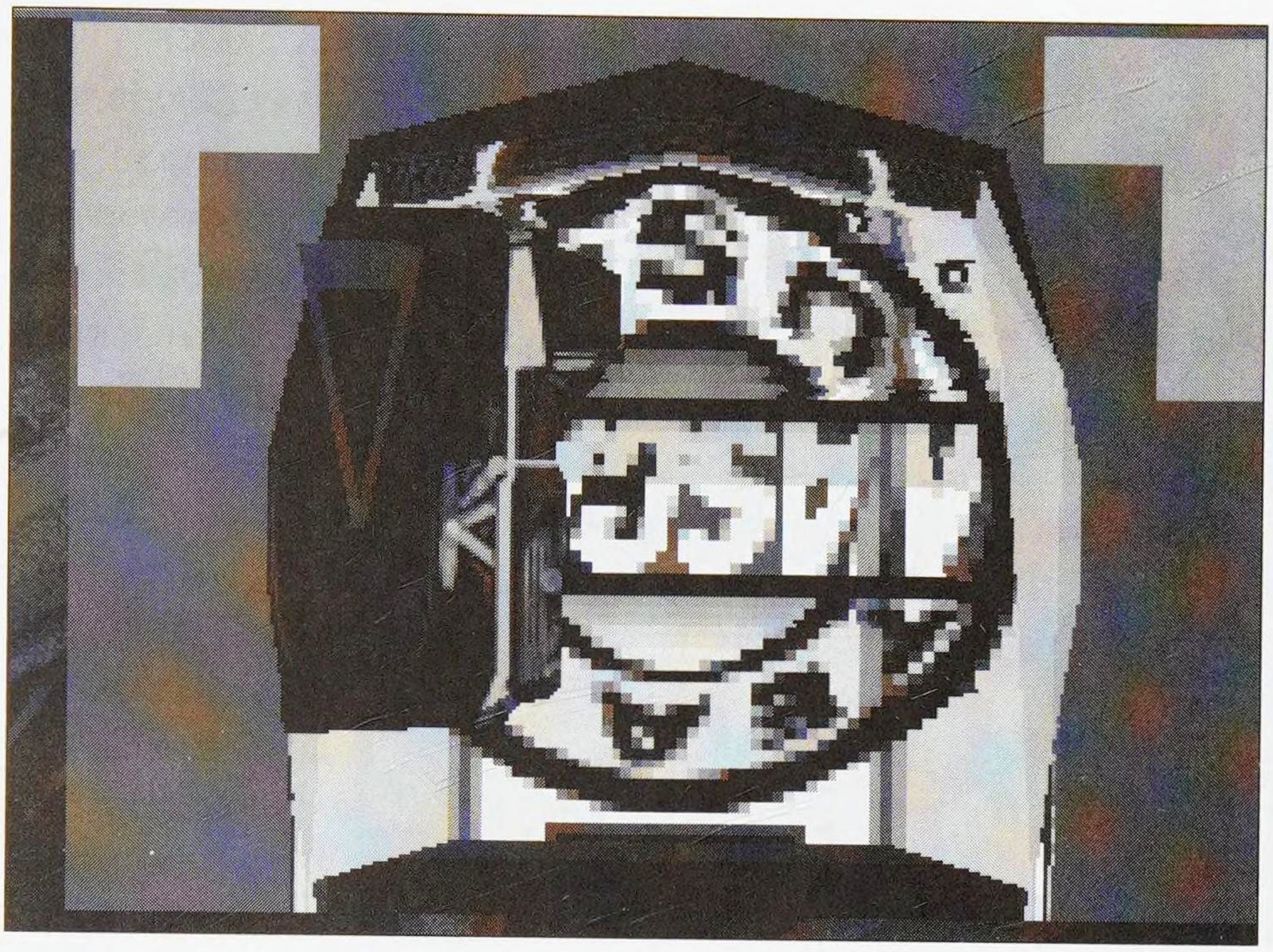


FIGURE 17.8: Wheel lock determines steering sensitivity. It's largely a matter of comfort and personal preference.

Adjust the setting downward to whatever level feels comfortable. I like a wheel lock of 9 or 10 degrees. Make sure you can get it adjusted sharply enough to make each turn, of course—but because you aren't going to be doing a three-point turn on the race track, keep this value as low as you can get by with. Come to think of it, you might have to make a three-point turn when your mangled car is resting up against the outside wall, pinned beside another car, but you won't be too concerned with wheel lock.

GEARING

The gear ratios determine how many RPMs your engine turns, and thus how fast your car can go. For the oval tracks—with the exception of Pocono—you're really only concerned about fourth gear since you don't change gears except when taking the green flag.

GEARING FOR THE OVALS

The manual suggests setting a fourth-gear ratio that revs high enough to cause the red warning light on the tachometer to come on at the end of the longest straightaway, but it's not quite that simple. True, this is a good rule for the short tracks, where you're more

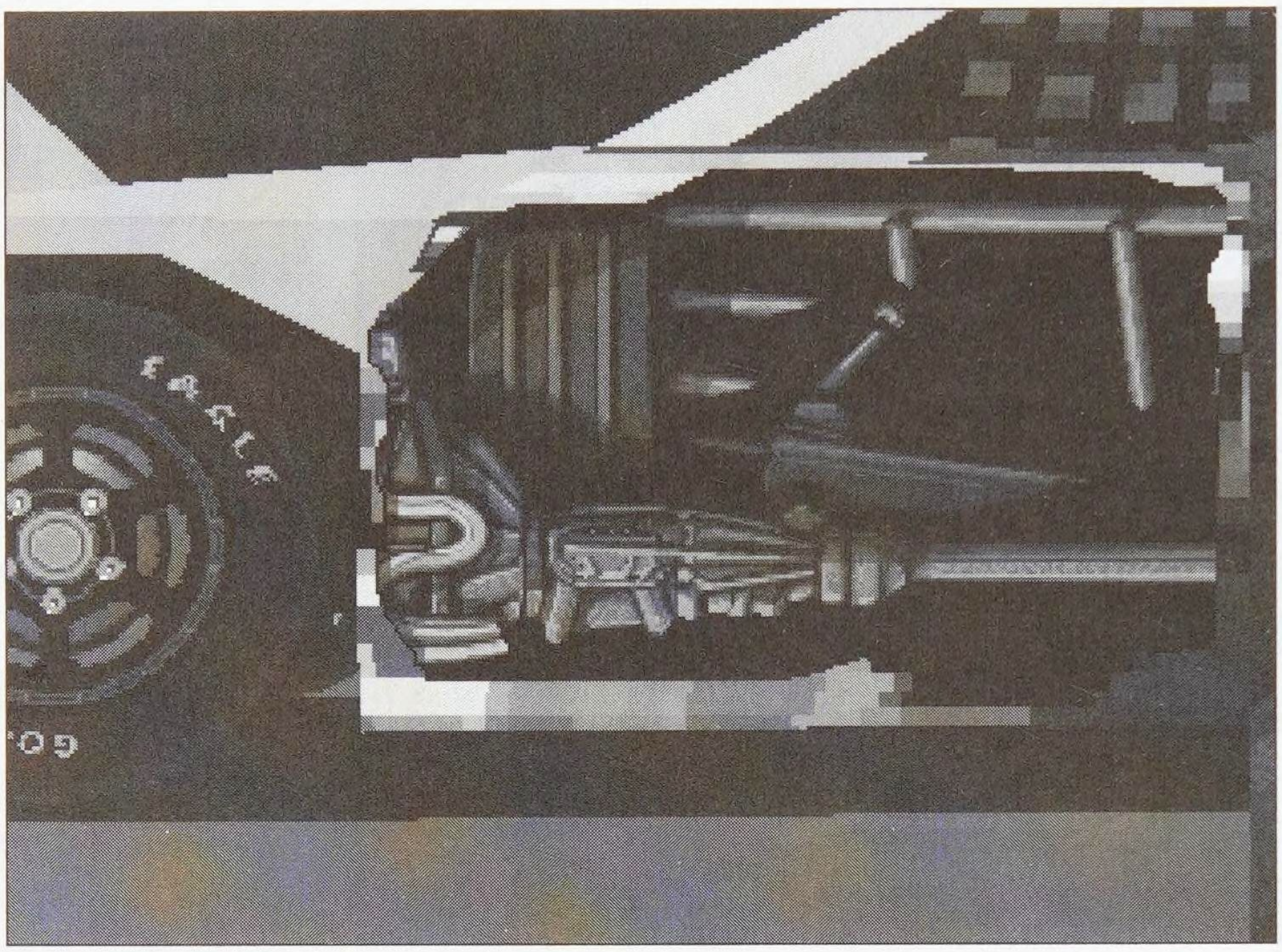


FIGURE 17.9: The lower the gear ratio, the more RPMs your engine will turn.

concerned with quick acceleration off the corners than pure speed at the end of the straightaways. Your lap times on a track like Martinsville, though, are more dependent on acceleration and cornering speed than on straightaway speeds. On those tracks, you want the tach light to come on just before you begin braking for the corner—at least on your fastest laps. If you're hitting 9,000 RPMs while you're taking it easy, however, you'll risk blowing the engine when you really need to stand on the gas. The same idea applies at the one-mile tracks, though straightaway speed is more of a concern there, so you have to balance the need for top-end speed versus the need for acceleration.

At the tracks of 1.5 miles and longer, the balance between speed and acceleration leans toward speed, especially at Talladega. Your car's engine generates more acceleration at 8,000 RPMs than it does at 9,000 RPMs. Forget for a moment about over-revving and damaging the engine. Even if you couldn't hurt the engine, you wouldn't want to red-line the tach for more than a couple of seconds at the end of a straightaway, because the car is no longer accelerating.

The tachometer's red line is 9,000 RPMs, but you should almost never reach that point on a superspeedway; you should be *approaching* 9,000 RPMs by the time you let off the gas.

NASCAR Racing faithfully models just about every aspect of a stock car's performance, including the consequences of over-revving the engine. You can shorten the fourth-gear ratio slightly from the stock Ace set-up for most tracks, but you shouldn't go much further. The dashboard gauges work, too, so you can watch what happens if you insist on pushing the powerplant past the breaking point. The oil pressure will drop and the water temperature will soar, and then . . . silence. Next thing you know you'll be standing in the pits, quaking in your boots while talking to a TV reporter: "Well, Glenn, we were just ridin' along there, waitin' for the last 100 miles to make our move, when the engine blew. We'll get 'em next week."

TIP

Don't limit your speed by a fourth-gear ratio that's too short. As you learn your way around a track, your line will get better and you'll pick up speed because your driving skills are improving. Let's say you're running Atlanta, and the tach light is flashing at the end of the front stretch heading into the first turn. You think you're running pretty hot laps, maybe in the 175 MPH range. But as you run more laps, you find you can stay in the throttle a split-second longer going into turn 1. Now you're clicking off laps at 177 MPH and reaching 9,000 RPMs. That's putting a greater strain on the engine and limiting your top-end speed. It's a good idea to leave yourself a little cushion in the gearing to allow yourself to get faster.

AERODYNAMICS

Of course, stock cars aren't stock anymore, but their bodies *must* have the same shape and dimensions as the cars on the showroom floors. NASCAR officials use templates to make sure race cars comply. As a result, these stock cars aren't the aerodynamic missiles of, say, the IndyCar or Grand Prix circuits. Instead, the race teams in NASCAR have to depend on the automakers in Detroit to come up with sleek designs. Teams are limited to front and rear spoilers when they want to make changes to the flow of air over the car.

Rear Spoiler

This thin strip of metal on the rear-deck lid has a tremendous effect on your car's performance. As air rushes over the car, it catches on the rear spoiler, creating down force. That down force makes the car more stable and lets it handle better, but it bleeds off speed. The higher the spoiler angle, the greater the down force. A lower angle reduces this effect, increasing speed at the cost of handling stability, as shown in Figure 17.10.

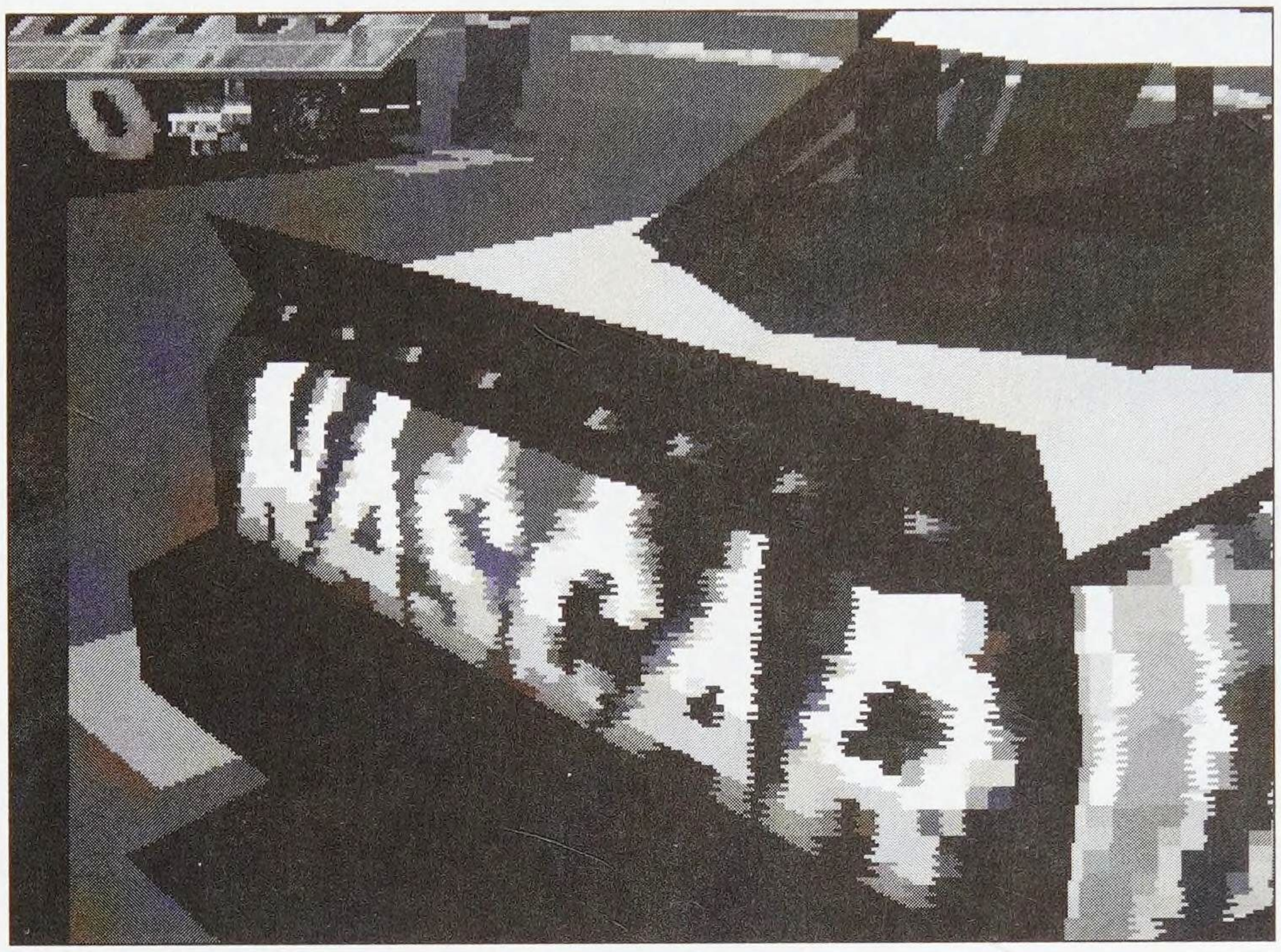


FIGURE 17.10: The rear spoiler setting is a trade-off between speed and handling stability.

At the faster superspeedways, you'll want a low rear-spoiler setting, while the short tracks require a high spoiler angle. The emphasis on top speed at Talladega requires the lowest allowable rear-spoiler angle. The slowest track, Martinsville, demands the maximum spoiler angle, 70 degrees.

The rest of the tracks fall somewhere between these extremes. You'll have to make the call, whether you want to sacrifice some straightaway speed for a more stable, better-handling race car. As you get faster and more confident at a track, try reducing the spoiler angle to see if you can gain some speed and still be able to handle the car comfortably in traffic. Be careful, though! Some of the faster tracks, like Charlotte and Atlanta, demand both speed and stable handling in the corners. Trim the rear spoiler too much at those tracks, and you'll get a taste of concrete.

Front Spoiler

The front spoiler, or air dam, catches air at the bottom-front of the car, creating down force that pushes the front-end of the car down to the track. You'll almost always want the front spoiler set all the way down to increase stability (see Figure 17.11). Talladega is again the exception to the rule. There, the need for speed requires a higher front-spoiler

setting to reduce drag. Start with the front air dam set to the maximum height. But if you're smokin' the rest of the field at Talladega (and you should), experiment with a lower setting to see if it makes the car easier to drive, especially through the tricky tri-oval.

QUALIFYING

When you have a fast race setup, you'll have a starting point for your qualifying setup. Don't worry about setting up a car for qualifying until you've come up with a fast, stable chassis for the race.

Many of the concerns that limit what you can do with a race setup don't apply in qualifying. You're only running a lap or two, so don't be concerned with conserving tires. In fact, you want a setup that quickly builds heat into the tires, or you'll be sliding all over the track. The real teams use specially designed qualifying engines, but we're stuck with the same tools we used for a race setup.

Slippin' and Slidin'

Like many aspects of setting up a race car, these factors depend largely on the track and your driving style. But at most tracks, you want a loose setup for qualifying.

NOTE

The brief but spectacular run of the muscle cars added some color to the automotive scene in the late 1960s, both for hot rods on the streets and on the race tracks of NASCAR. The high-winged, aerodynamically designed Dodge Charger, Plymouth Superbird, Ford Torino, and Mercury Cyclone took factory involvement to new heights—and took "stock" car racing to unheard-of speeds. In 1968, a young Cale Yarborough sped around Daytona in a Wood Brothers Mercury at 189.222 MPH, nearly 10 MPH faster than the previous one-lap record. By then, of course, there was very little that was "stock" about these stock cars. The automakers adhered to the letter, if not the spirit, of NASCAR rules by producing a few hundred of these high-speed models for the general public. Afraid the sport was moving away from its roots, NASCAR took steps to limit the impact of these specially designed models. A new rule for 1970 models required that at least a thousand of a particular design be built, to qualify for the circuit. With mounting public and governmental concern over the environment, and with energy conservation beginning to stir, Detroit started pulling back—and the era of the muscle cars was soon over.

You'll want just enough fuel in the tank for the one or two laps of the qualifying run. When you're running with only a gallon or two, the car's handling characteristics can change drastically. In a race, the car tends to get tighter—develops a push—as it burns through the 22 regulation gallons of fuel. Your race setup, then, is likely to be much

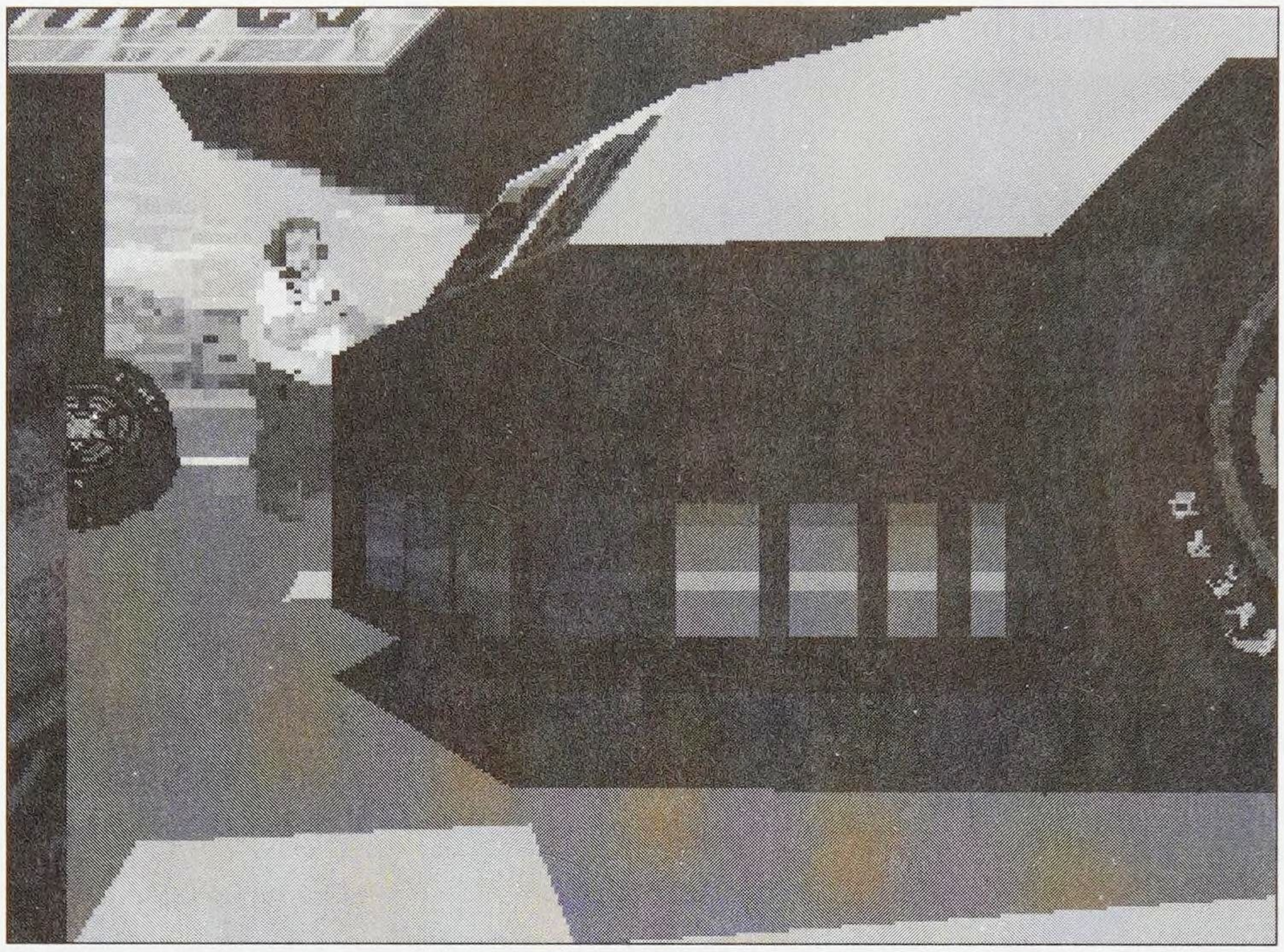


FIGURE 17.11: The front air dam is usually at the lowest setting.

tighter than you're used to. Consult the table at the end of this chapter for the various adjustments to loosen up the car, but we'll take a look at some general pointers here.

GEARING Starting with your race setup, shorten fourth gear by two or three steps. On the short tracks, you should be red-lining the tachometer at the end of each straightaway. Even on the superspeedways, you'll want to see that red light flash before you let off the gas. But remember, don't limit your top-end speed by red-lining too far before the end of the straightaway.

SUSPENSION Softening the rear shocks will move some of the weight to the front end of the car, helping to compensate for the light load in the fuel tank. This should make the car easier to turn and reduce the push condition. Keep the shock at 100 percent on that pesky left-front wheel, though, to get that tire as hot as possible.

WEIGHT You can also experiment with weight jacking to give you a faster, looser setup and fight the push that develops with a low fuel load. Increasing the rear bias and decreasing the wedge should make the rear-end plenty loose.

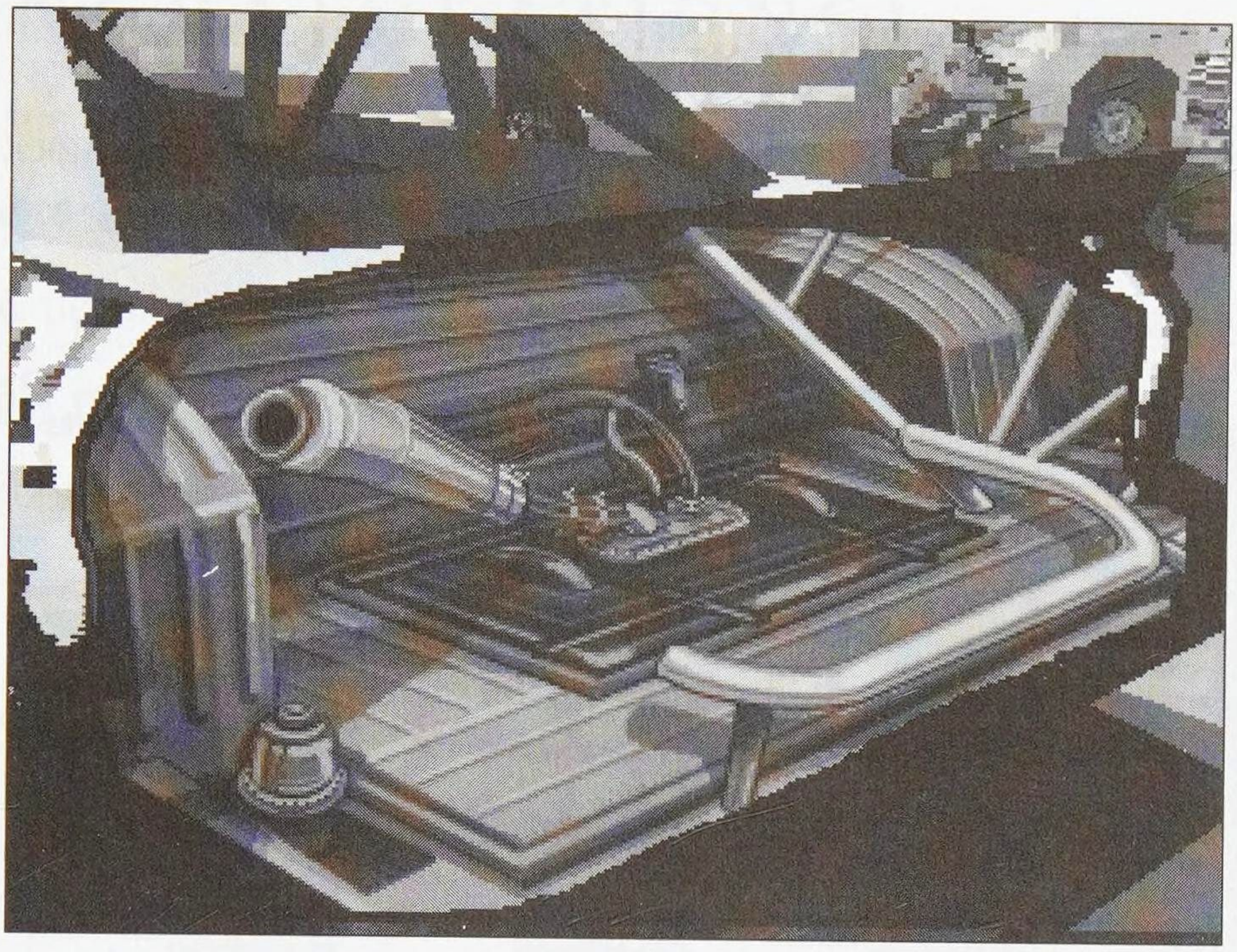


FIGURE 17.12: Load only as much fuel as you need for qualifying.

SPOILERS If you've already found a comfortable and fast compromise between speed and down force with your spoilers, you should probably stick with it for the qualifying setup. It's worth experimenting, though, with a lower rear spoiler to see if you can gain some straightaway speed without losing cornering speed. You don't have to worry about traffic, so you might pick up a tick on the clock if the car will still handle well enough for you to find the line and stick to it.

TIRES For the tires that run cold—almost always the left-front on an oval—try a hefty decrease in the pressure. That will cause the tire to sag and overheat the outside of the tire's contact patch, but who cares? It'll get hotter, it'll grip better, and you're only asking for a couple of laps out of it.

On the fastest superspeedways—Talladega and Michigan— try overinflating the tires to about 60 pounds. The tires will bulge and overheat in the middle, but it'll give you faster straightaway speed.

Yes, More Practice

Though you started with a tried-and-true race setup, all these changes result in a qualifying setup that bears little resemblance to your race-ready configuration. You don't

have to worry about overheating tires, but you still have to keep this beast off the concrete while you try to drive around a track faster than you ever have.

You'll be battling a necessarily loose setup, so take the time to run several mock qualifying runs to see just how hard you can drive and still keep the car in one piece.

PROBLEM	TIRES	STAGGER	SHOCKS	LEFT BIAS	REAR BIAS	WEDGE	GEARING	WHEEL LOCK	SPOILERS	DRIVER
Loose or oversteer	Lower rear tire pressure	Decrease			Decrease	Increase			Raise rear spoiler	
Loose exiting turn	Increase left-front tire pressure; lower left-rear		Stiffer left-front shock; softer left-rear shock							
Loose entering turn	Raise right-front tire pressure; lower right-rear		Stiffen right-front shock; soften right-rear							
Pushing or understeer	Lower front tire pressures	Increase	Softer right-front shock		Increase	Decrease			Lower front air dam; Less rear	spoiler
Pushing exiting turn	Lower left-front tire pressure; raise left-rear		Soften left-front shock; stiffen left-rear							
Pushing entering turn	Lower right-front tire pressure; raise right-rear		Softer right-front shock; stiffer right-rear shock							Back off earlier going into turns
Erratic steering								Decrease		
Tire too cool	Decrease air pressure		Stiffer shock							
Tire too hot	Increase air pressure		Softer shock				Slow down			Slow down
Losing grip in turns		Increase		Increase						Slow down
Slow speed on straight-aways							Shorter 4th gear		More rear spoiler; reduce air dam	
Slow speed in corners	Increase tire pressures	Increase								
Over-revving on straight-aways							Taller 4th gear		Raise rear spoiler	

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OW TO INSTALL THE CD-ROM

To install the easy-to-use interface that will let you browse and install the CD-ROM's contents:

1. In Program Manager, from the File menu, select the Run command.
2. In the Run window, type `D:\INSTALL` and press Enter. If your CD-ROM drive is not your D drive, replace the D with the correct letter.
3. The Installer will create an icon in Program Manager for Interactive Entertainment's point-and-click program. This program will assist you in installing the games on the CD-ROM.

For Windows 95 Users:

The Best Simulation Games demos included on this CD-ROM have been tested on Windows 95 machines running DOS in protected mode (MS-DOS Mode).

If an installation of one of the games below does not work from a Windows 95 window, restart your computer in MS-DOS protected mode (reboot the computer, press F8 when the Starting Windows message appears, and then select MS-DOS mode). Then, install the game from the DOS prompt, directly from the appropriate directory on the CD.

(Many of these games require too many resources to be shared within Windows 95.)

The following games on this CD-ROM require a few extra steps before you can jump into the cockpit.

iM1A2 Abrams: *America's Main Battle Tank*

TO RUN *iM1A2 Abrams* This pre-alpha demo requires a Pentium and 16MB RAM, though the final version is expected to run on a 486 with 8MB RAM. The game requires Windows 95. To install iM1A2, move to D:\DEMOS\iM1A2\DISK1 directory (where D: is your CD-ROM drive) and run SETUP.EXE. To run the game, move to the directory where you installed it and run ABRAMS.EXE.

ABOUT *iM1A2 Abrams* The long-rumored Interactive Magic tank simulator is almost here! This is a *very early* alpha demo. Not all features are implemented, and the code is not even close to optimized. Look at it as a glimpse into the near future, rather than as a representation of how the finished product will perform.

TROUBLE? Should you have any problems you can contact Interactive Magic's Technical Support department at 919-461-0948 but remember, this is a pre-alpha demo and you may not get full support for it.

Hind Demo

TO PLAY *Hind* Demo *Hind* is a Windows 95 program. After the installation, you will have an entry called "Hind 95" added to your program group and an icon called Demo, which will start the game.

ABOUT *Hind* *Hind* is a helicopter sim that follows up I-Magic's hit, *Apache.* The demo allows you to fly in either arcade or realistic mode. Please note that the demo has an automatic enemy target tracking system. When you are in the gunner's position, your view will scroll left and right to automatically find the next target. To turn this feature off (so that you can track the next enemy target), hit the S key.

TROUBLE? Should you have any problems running the demo contact Interactive Magic's Customer Support at 919-461-0948 between 9 a.m. and 9 p.m. EST Monday through Friday.

Silent Hunter

TO PLAY *Silent Hunter* After installation, exit CGCD and Windows, move to the directory where you installed Silent Hunter and type SH.

ABOUT *Silent Hunter* Lush graphics and sound combine with historical accuracy in this submarine sim.

TROUBLE? Should you have any problems running the demo contact SSI's Technical Support department at 408-737-6850, from 9 a.m. to 5 p.m. PST, Monday through Friday.

SU-27 Flanker

TO PLAY *SU-27 Flanker* Click Done to close this text window. Highlight SSI's *SU-27 Flanker* on the ads and demos menu, click the install button, and follow the instructions. PLEASE NOTE THAT THIS DEMO IS DESIGNED TO RUN WITH WINDOWS 95!

ABOUT *SU-27 Flanker* Modeled after the Soviet SU-27 Flanker by a team of Russian aerospace professionals, SSI is calling this game the first flight sim developed to run under Windows 95.

Trouble? For assistance running the *SU-27 Flanker* demo, contact SSI technical support at 408-737-6850 between 11 a.m.–5 p.m. Pacific time Monday through Friday, excluding holidays.

Apache

***Apache* Installation** To install the *Apache* demo, switch to the "Apchdemo" directory on the CD-ROM then type INSTALL. Once the demo is installed, switch back to your hard drive, then change directories to the "Apchdemo" directory. Type `Apache` to run the demo. Sound and other controllers can be configured once the demo is running by accessing the Preferences option. If you have any problems running the demo, please call Interactive Magic's Technical Support Hotline at 919-461-0722, Monday through Friday from 9 a.m. to 5 p.m. EST.

WINDOWS 95–ONLY GAMES

Please note that these games will only run with the Direct-X Windows driver for Windows 95. Please read the warning that Direct-X may corrupt the video drivers on some system and Sybex will in no way be liable.

THE PLAYABLE GAME DEMOS INCLUDED ON THE CD-ROM ARE:

Silent Thunder
Top Gun: Fire at Will
Su-27 Flanker
Apache
Silent Hunter
Hind
Air Warrior
iM1A2 Abrams
Nascar Racing 2
IndyCar Racing II
Jetfighter III
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